# FOOD Manufacture

ACCELERATED FREEZE DRYING

A PUBLICATION OF THE LEONARD HILL TECHNICAL GROUP

Vol. 36 No. 2

FEBRUARY 1961

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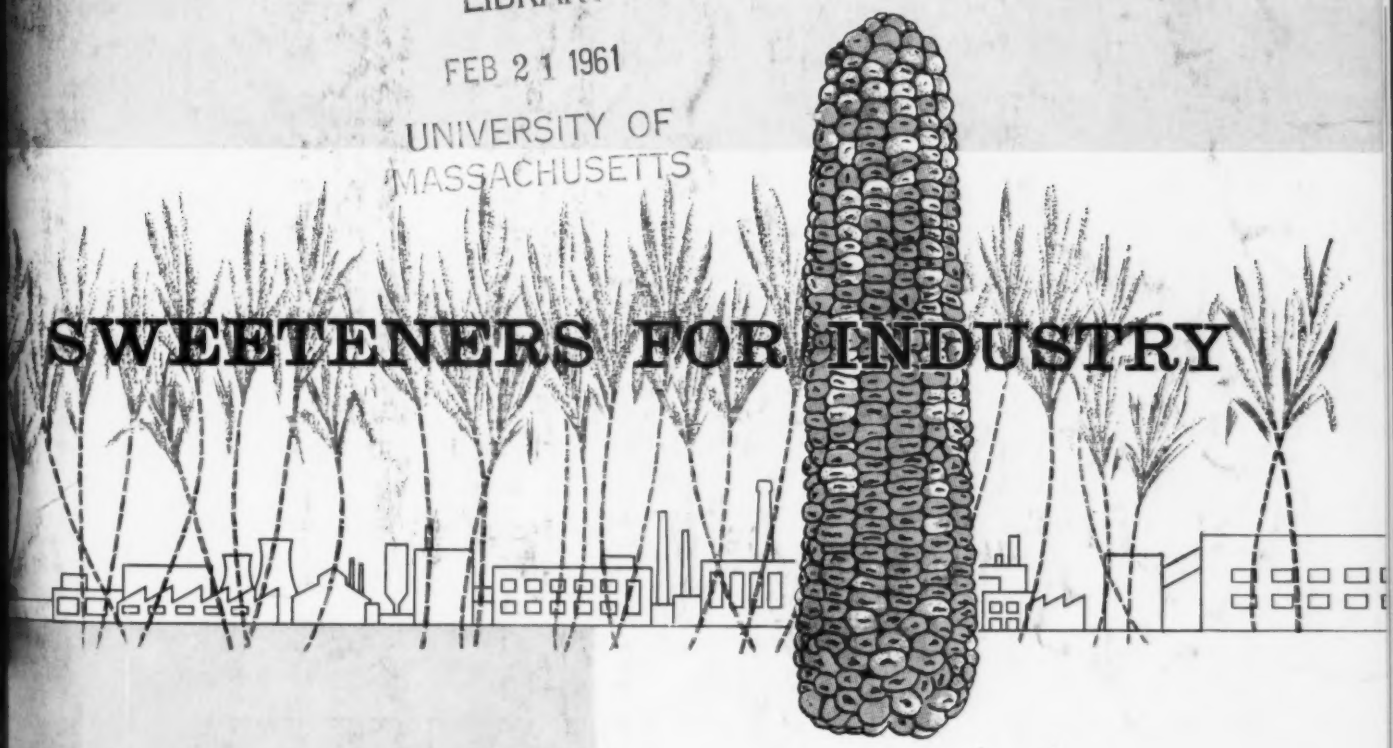

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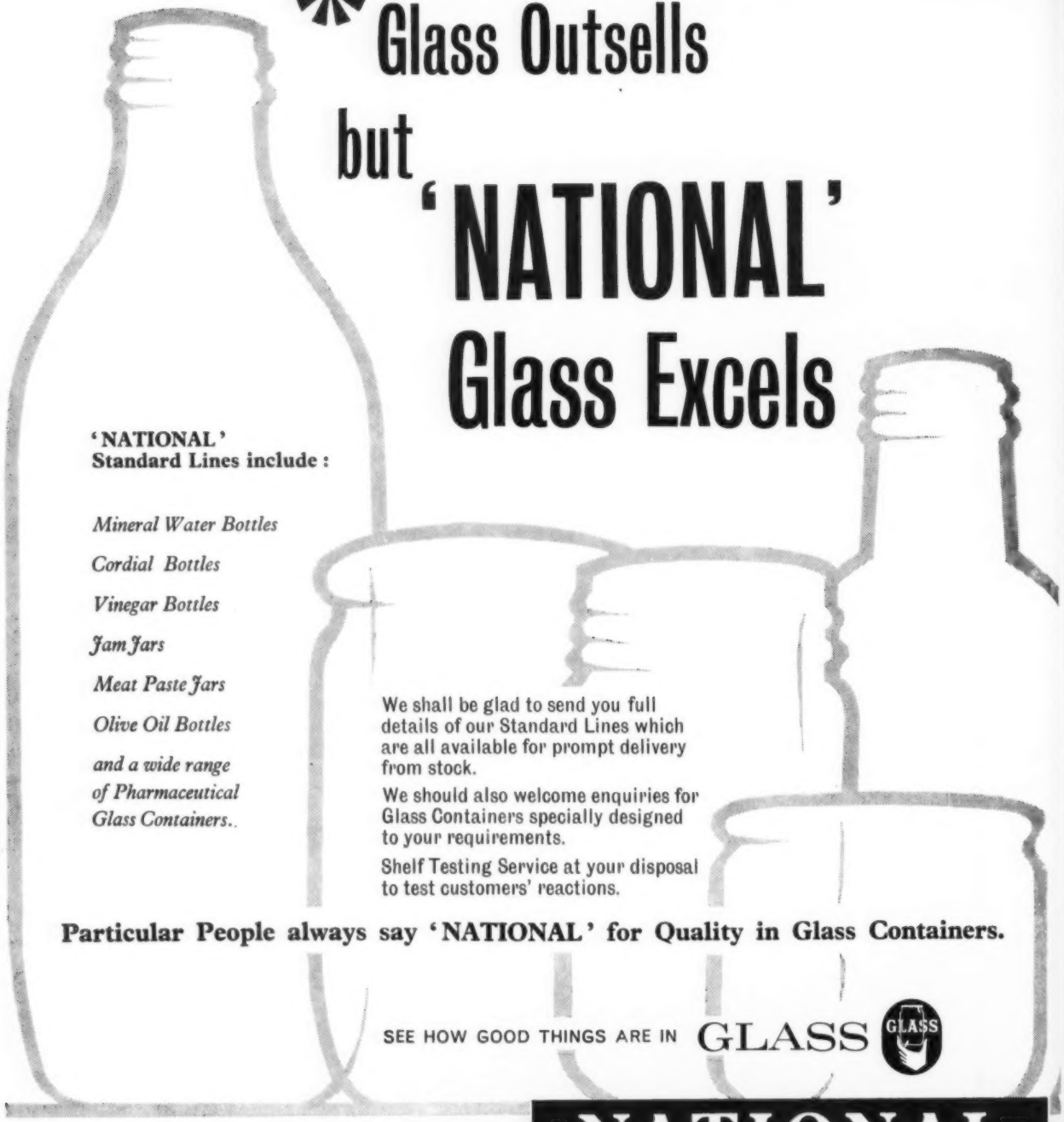

# Glass Outsells but 'NATIONAL' Glass Excels

**'NATIONAL' Standard Lines include :**

*Mineral Water Bottles*

*Cordial Bottles*

*Vinegar Bottles*

*Jam Jars*

*Meat Paste Jars*

*Olive Oil Bottles*

*and a wide range of Pharmaceutical Glass Containers..*

We shall be glad to send you full details of our Standard Lines which are all available for prompt delivery from stock.

We should also welcome enquiries for Glass Containers specially designed to your requirements.

Shelf Testing Service at your disposal to test customers' reactions.

**Particular People always say 'NATIONAL' for Quality in Glass Containers.**

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*Independent Research at self-service stores has shown that when identical products are offered in Glass Containers and in an alternative pack side by side, Glass outsells the other.*
*May we send you full details of this most enlightening Research?*

Regd Trade Mark

# THE FOODTECH RANGE—

## *The largest range of Food cutting and preparing machines in the world*

1

### THE FOODTECH CUT MIXER

High Speed (1,000—4,400 r.p.m.) heavy duty chopper and emulsifier. Accepts any kind of frozen meat or fish, cuts cleanly into particles (coarse cut), or produces a smooth emulsion. Also chops and blends fruit, vegetables and butter. Capacity up to 800 lb.

2

### THE UNIVERSAL K.S. MINCE-MASTER

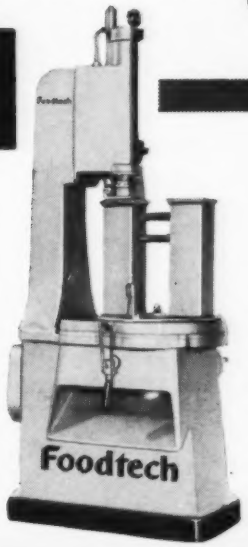
Over 200 satisfied users of this machine in the U.K. alone. Accepts *all* foodstuffs—even the toughest—and reduces in seconds to a smooth, uniform mix that remains consistent for more binding power and better colour.

3

### THE FOODTECH MINCER

High speed fully automatic mincer, output up to 6 tons per hour; smaller models in many sizes.

4




### THE FOODTECH DICER

A robust, heavy-duty dicer that will cut frozen meat, fat and vegetables into cubes of exact dimensions.

5

### FACTORY LAYOUT

Foodtech's Managing Director, Mr. P. H. Hilgeland, is an expert in this field and will gladly advise you. Whether you are installing one machine or equipping a new factory, please contact him. You will incur no obligation.

# Foodtech Ltd.

**581a & 581b Green Lanes, Harringay, London, N.8**
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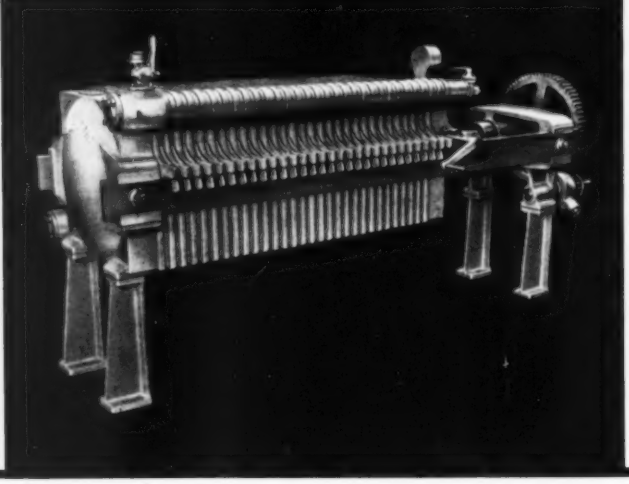

Illustrated is a Cast Iron 31½" sq. "KJ" Filter Press with a closed delivery outlet. The filter is suitable for use with a full range of filter cloths, and for polishing or additional clarity filter papers can be used. Filter Presses are also made in Stainless Steel, Aluminium, Gunmetal and Timber in a variety of designs and are provided with suitable pumping machinery.

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Products packed in glass start with a definite advantage. The housewife trusts glass to protect perfectly, and not to affect the quality of the goods she buys. Glass lets her see for herself exactly what she's buying. It is because glass itself is so attractive, so clean and sparkling, that it gives just that look of extra quality that swings the sale in its favour. Something new and interesting is always happening in the lively glass container industry. Your Glass Manufacturer will be happy to discuss current developments with you.

## Prove it with a Practical Test on your own Products

Use the Glass Container-Acceptance Testing Service to test consumer reaction to new pack designs *before* they go into mass production. This *free* service enables you to test packs in any, or all, of the following progressive stages:

**DESIGN PREFERENCE TESTING** Any new design can be tested on a consumer panel of 400 families.

**CONTAINER IN USE TESTING** The new container and its product can be tried out in actual use in the home.

**SHELF TESTING** The sales appeal of a new container can be tested under actual retail store conditions.

Full details of this service are contained in a booklet available upon request from your Glass Manufacturer or from the Federation.

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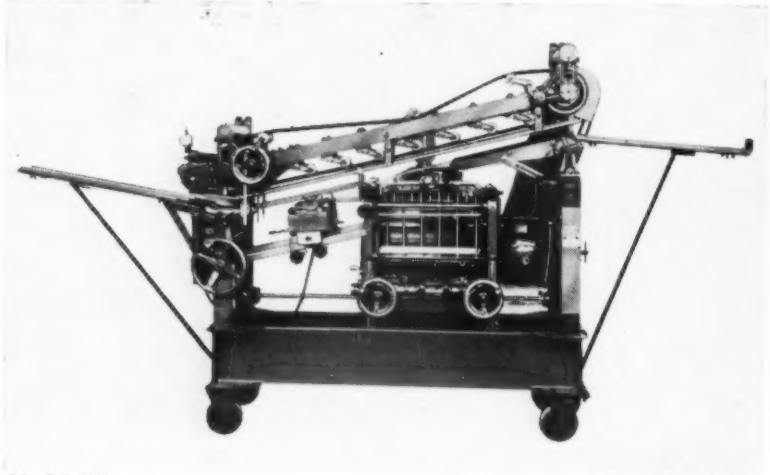

Model E 5 — Leaflet NWL·1

THE
**'E 5. CAN LABELLER'**
JUST ONE from our wide range of semi and fully automatic
**LABELLING MACHINES**

**This heavy duty "NEW-WAY" model E 5. straight through can labeller incorporates a new elevating feature with high discharge point that in many cases permits direct gravity feed to the "caser".**

Handles tin, glass, fibre or other cylindrical containers from 108 to 502 (1½" to 5½") diameter by 112 to 708 (1¾" to 7½") in height, without use of change parts. Change from one size to another taking only 2 minutes. Other features include: infinitely variable speed drive, 2 kW gum pot heater with accurate thermostatic control, also simple and positive regulation of the "lap" paste.

*It will handle up to 500 or more containers per minute, with equal facility, depending on size of can and consistency of feed. The label magazine holds 3,000 labels and can be refilled without stopping the machine.*

***use PURDEX GUM in all Labelling Machines.***

**PURDY MACHINERY CO. LTD.**
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VITAMIN C

*Roche Pure Vitamin C—*

* Has demonstrated its value in preserving natural colour and flavour in frozen fruits.
* Is ideal for standardizing the Vitamin C content of processed juices—Citrus, Apple, Pineapple and Tomato.
* In *cured* meats, can significantly reduce curing time, give more uniform colour and help to maintain better colour and flavour during storage, distribution and display.

*Full information from*

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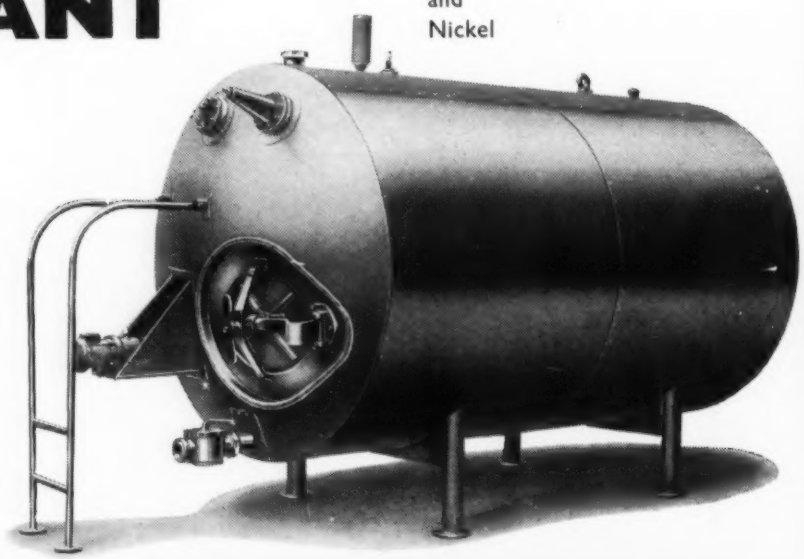
*Illustrated above: 40 gallon Stainless Steel Ketchup Tanks.*

*Illustrated on right: 1,000 gallon Stainless Steel Cream Storage Tank.*



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# let IMC solve your fi

If you have a filling problem in your plant, whether it be for solid packs with brine, syrup, oil or other liquids, or the more complicated filling of paste or mixed foods, IMC has the answer for you. Here is shown a typical high speed IMC 520 Pea and Bean Filler featuring unsurpassed accuracy of both product and liquid fill. Speeds up to 350 cans per minute are being realized in installations throughout the world

The insert shows the FMC-IMC 20 Pocket M & S Piston Filler for viscous products. It is capable of speeds up to 600 cans per minute depending on product and can size.

IMC-FMC Fillers, manufactured in Europe under rigid standards long proven and adopted by canners throughout the world, offer you these advantages :

**LABOR SAVINGS :** When close-coupled to closing machine, one man operates both machines.

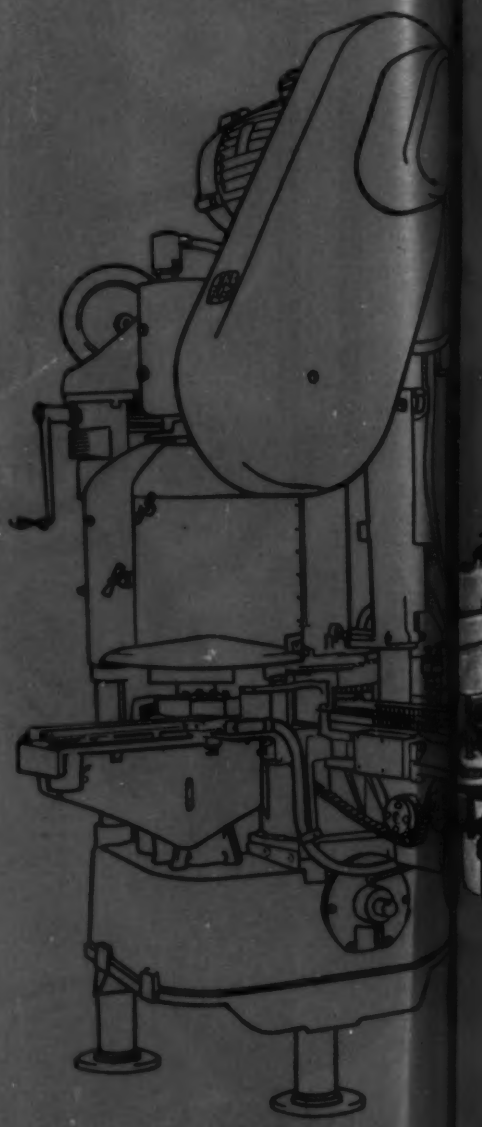
**ELIMINATES WASTE :** Automatic No-Can, No-Fill device on both product and liquid sections.

**ACCURACY OF FILL :** Provides greatest accuracy on widest range of products of any fillers available today. Volume of fill is readily adjustable on all IMC Fillers

**LONG LIFE :** IMC Fillers are built to highest standards of materials and workmanship assuring years of dependable operation with minimum of maintenance

**RAPID CHANGE-OVER :** Change from one size to another is accomplished quickly and easily within the range of the machine.

*IMC-FMC equipment is the most widely used food processing equipment in the world. It is now built in Europe and readily available to meet your specific needs.*



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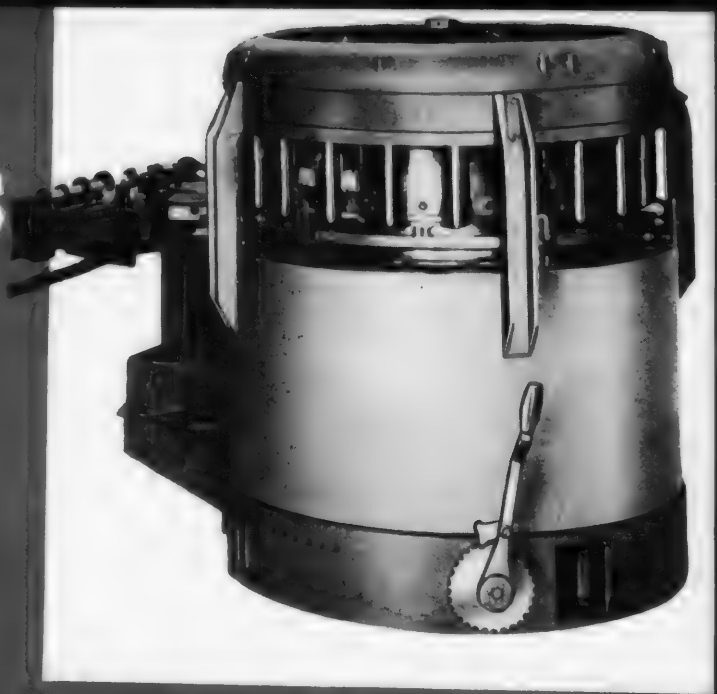

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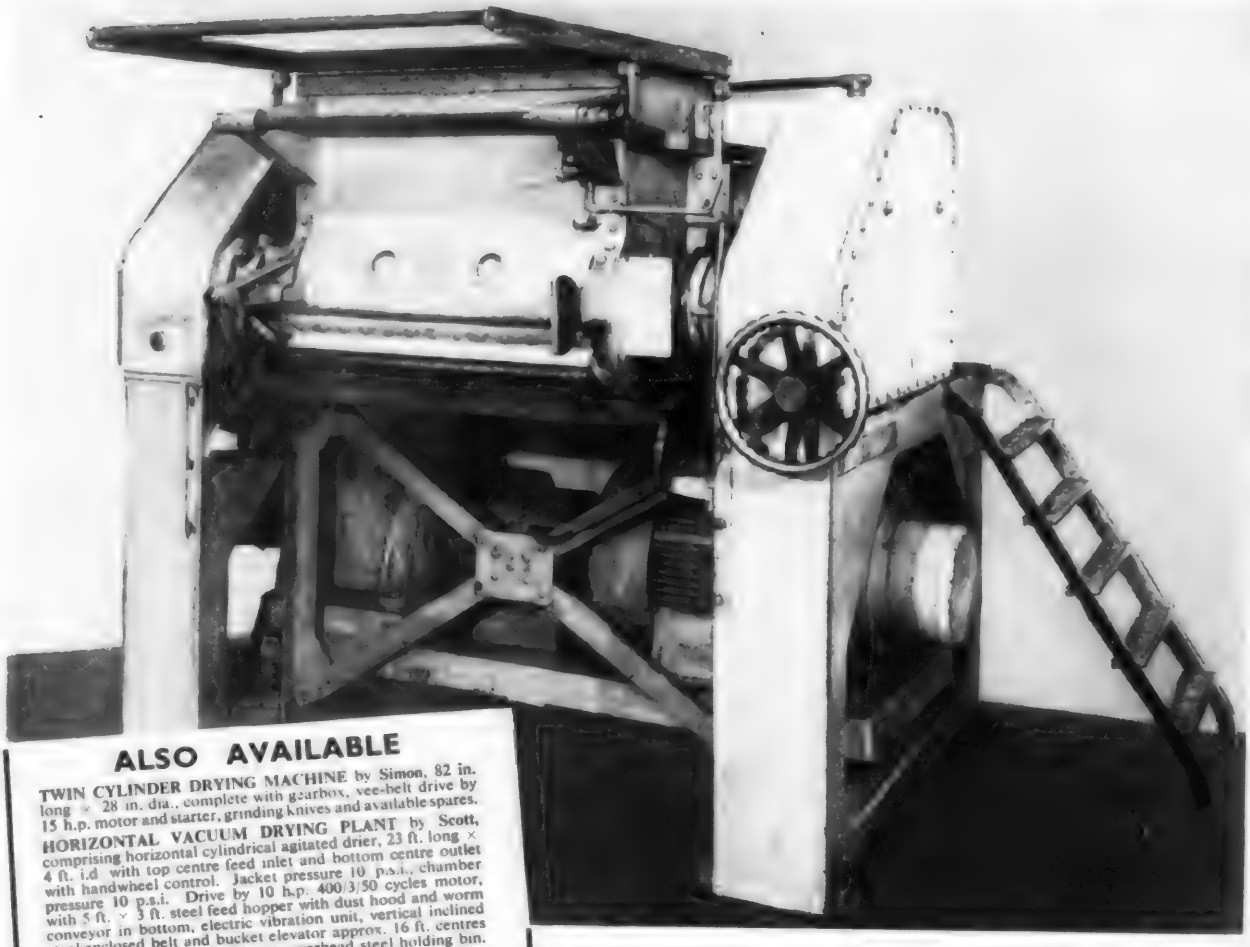

## ALSO AVAILABLE

**TWIN CYLINDER DRYING MACHINE** by Simon, 82 in. long × 28 in. dia., complete with gearbox, vee-belt drive by 15 h.p. motor and starter, grinding knives and available spares.

**HORIZONTAL VACUUM DRYING PLANT** by Scott, comprising horizontal cylindrical agitated drier, 23 ft. long × 4 ft. i.d with top centre feed inlet and bottom centre outlet with handwheel control. Jacket pressure 10 p.s.i., chamber pressure 10 p.s.i. Drive by 10 h.p. 400/3/50 cycles motor, with 5 ft. × 3 ft. steel feed hopper with dust hood and worm conveyor in bottom, electric vibration unit, vertical inclined steel enclosed belt and bucket elevator approx. 16 ft. centres driven by ½ h.p. motor, 17¼ cwt. overhead steel holding bin. Rotary brush sifter, Scott motorised horizontal single-cylinder pump, 10 ft. high × 12 in. dia. Vertical condenser.

**OCTAGONAL DRYING DRUM**, approx. 82 in. across flats × 39 in. wide with 39 in. × 23½ in. feed opening secured by 14 swing bolts. Drum of welded mild steel construction driven by 3 h.p. motor. With Sturtevant No. 1 motorised blower and heating chamber, cyclone, and ancillary equipment.

**VACUUM DRYING OVEN** by Scott, ribbed cast iron construction in bolted sections, 4 ft. 3 in. × 6 ft. 3 in. × 6 ft. 1 in. high internally, with 9 coil shelves of ½ in. mild steel tube at 9 in. pitch with vertical headers at rear of oven. Suitable for 27/28 in. vacuum, fitted heavy dished sliding door. Complete with horizontal double pass shell and tube condenser, horizontal cast iron receiver, piping, valves.

**UNUSED STAINLESS STEEL JACKETED TILTING MIXING PAN** by Brierley, Collier and Hartley, inner pan 3 ft. 4 in. × 2 ft. 8 in. with hemispherical bottom. Stainless steel anchor type agitator overdriven through gearing by hydraulic motor. Max. pressure 1,500 p.s.i. Jacketed pouring lip. Tilting by handwheel through gearing with counter-balanced weights. Supported in "A" frames on base.
TWO AVAILABLE.

**No. 7 SWEETLAND PRESSURE FILTER** by Dorr Oliver, filter body cast iron construction, 2 ft. 1 in. dia. × 6 ft. 10 in. long internally, 20 mild steel woven wire leaves spaced at 4 in. with sight glass connections. Suitable 50 p.s.i. w.p.

**YEAST SEPARATOR or ROTARY VACUUM FILTER** by Briggs, 24 in. dia. metal drum with 9 in. wide effective filtering area. Drum mounted in copper trough and underdriven from worm reduction gear with shaft drive from vertical wet vacuum pump. Vee drive from 3 h.p., 346 3 50 cycles motor.

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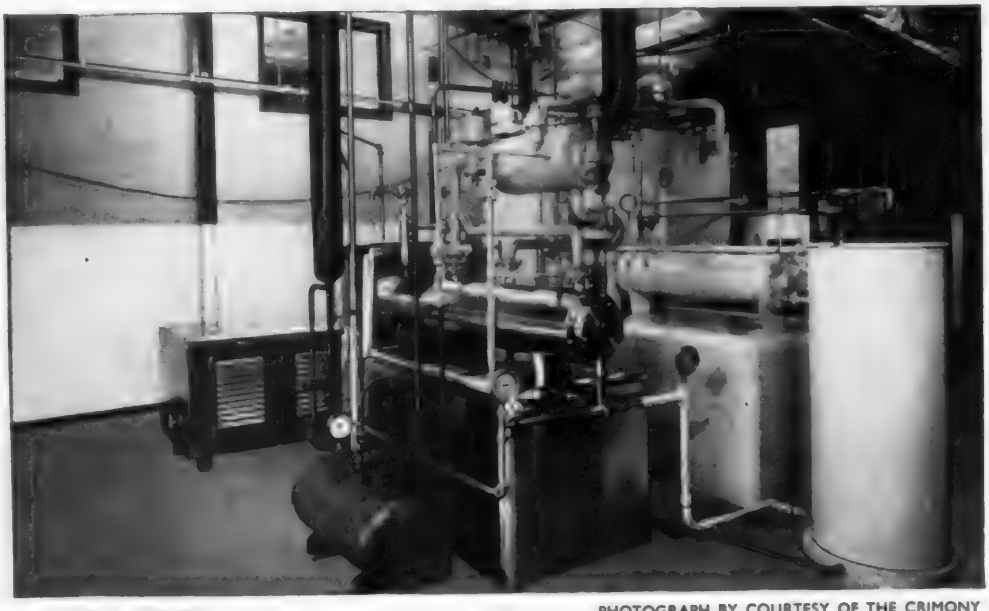
# Modern Margarine Making



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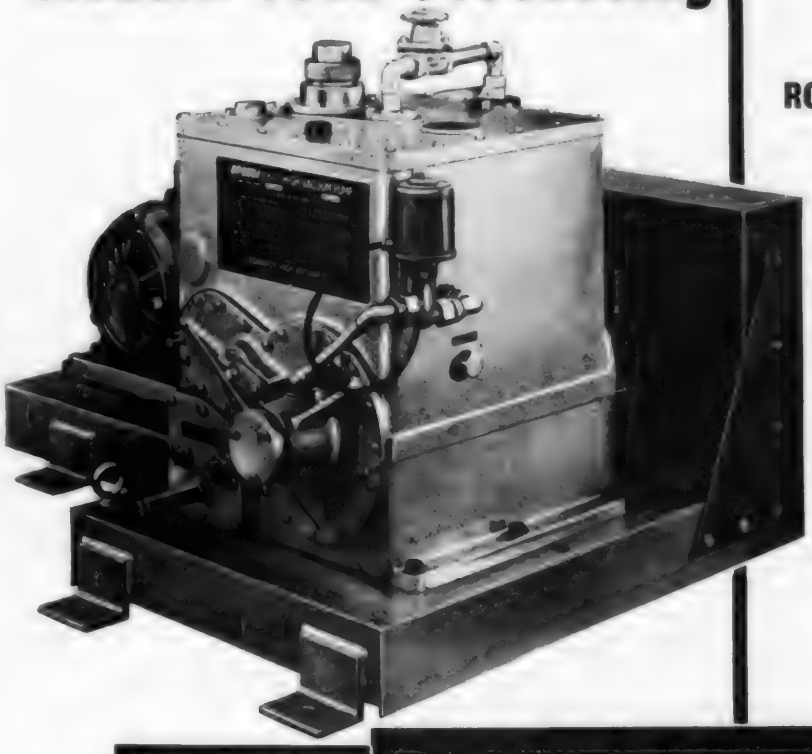
# Modern Food Processing



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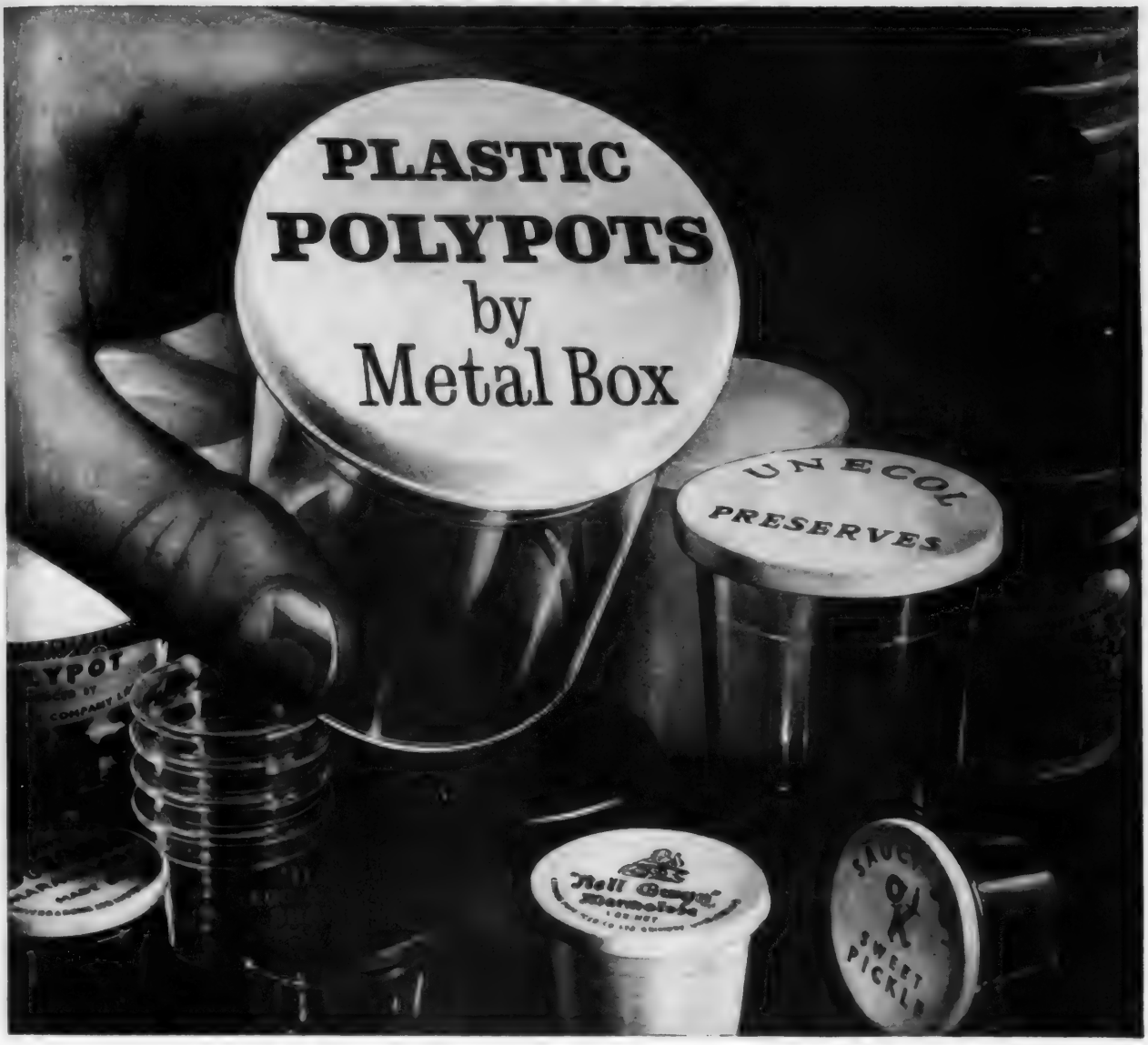


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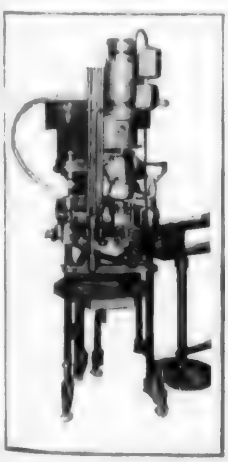

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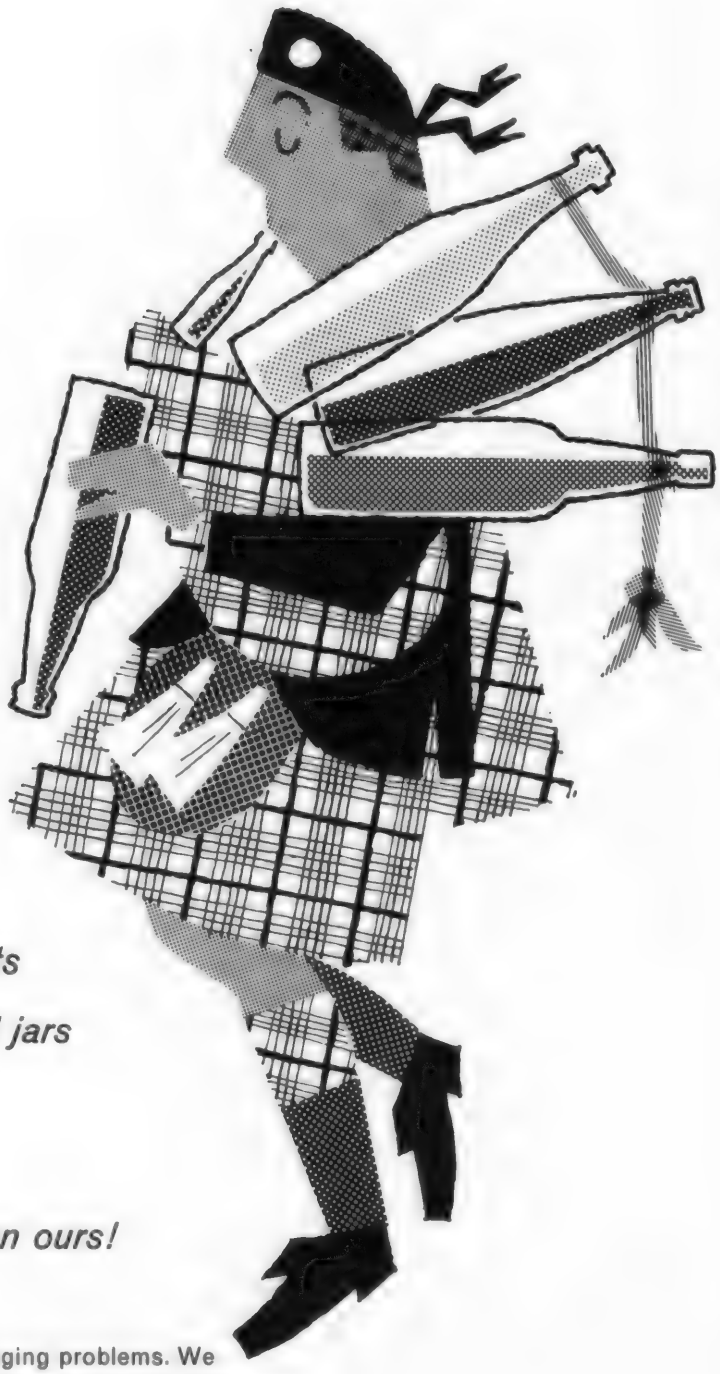

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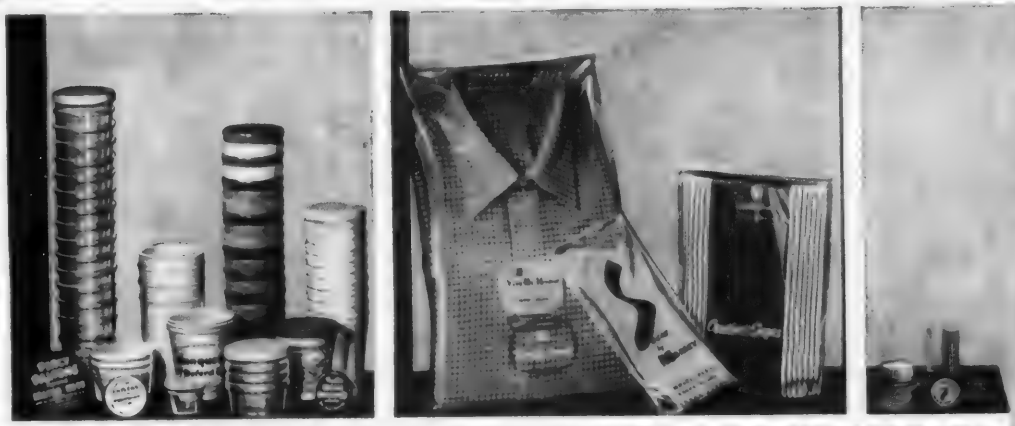

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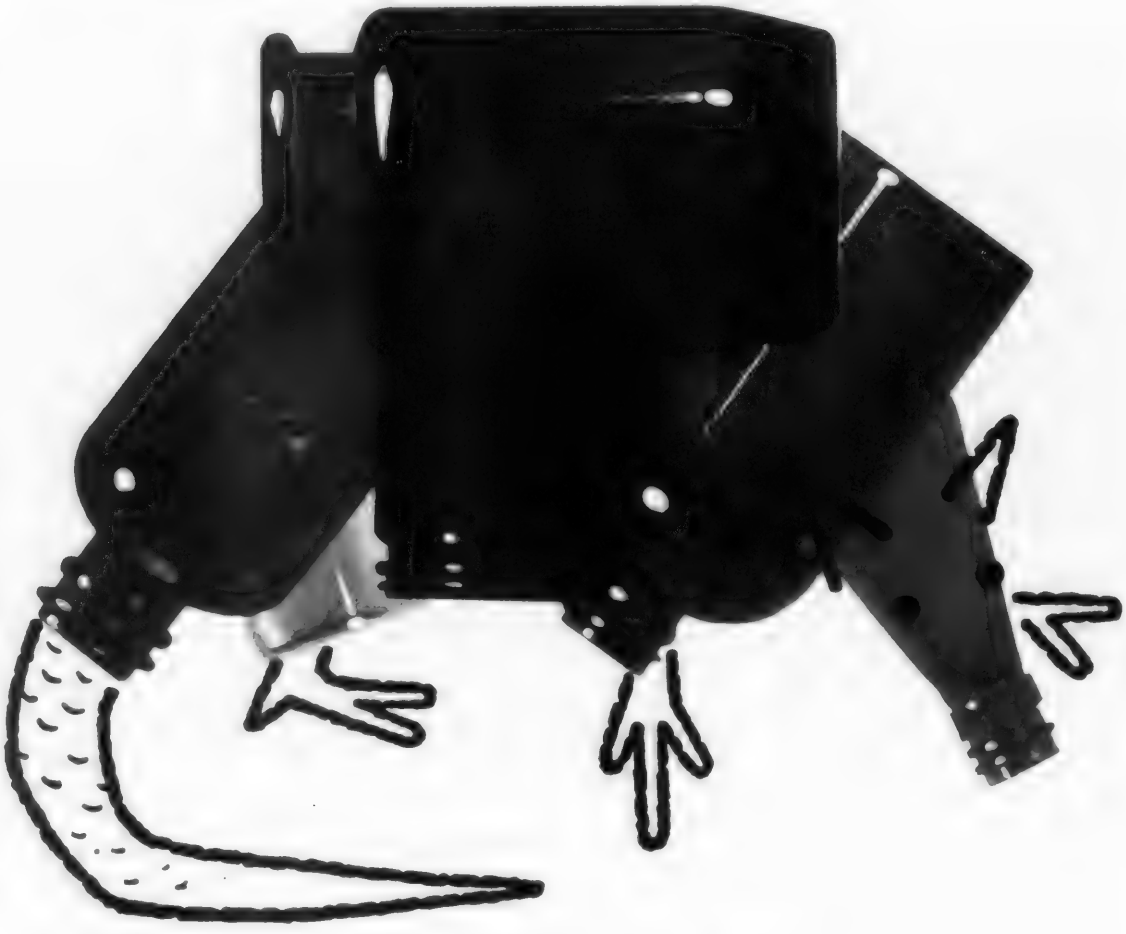

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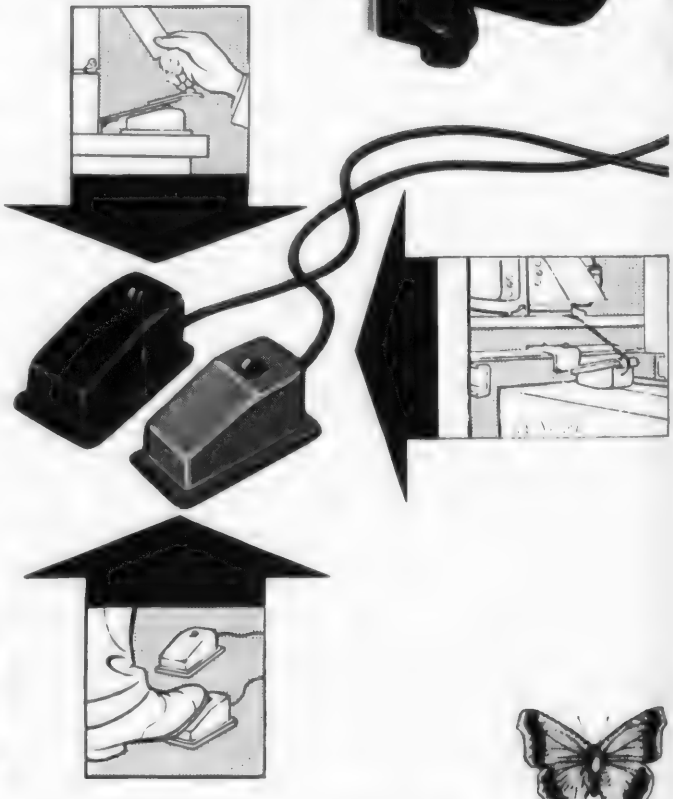

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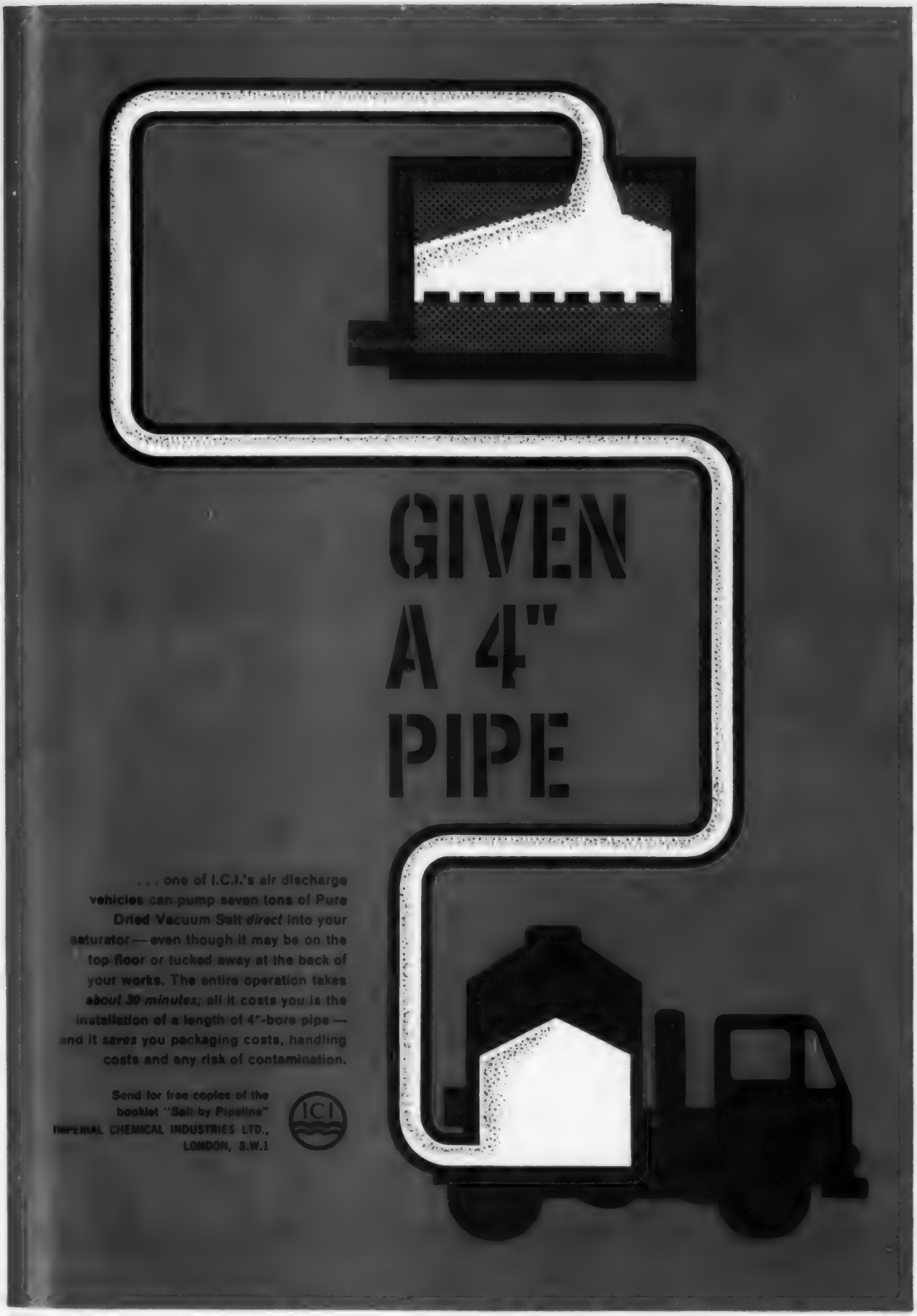
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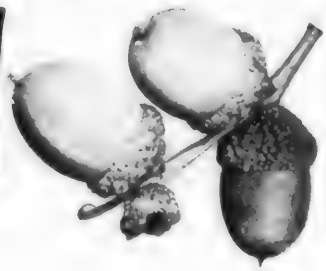

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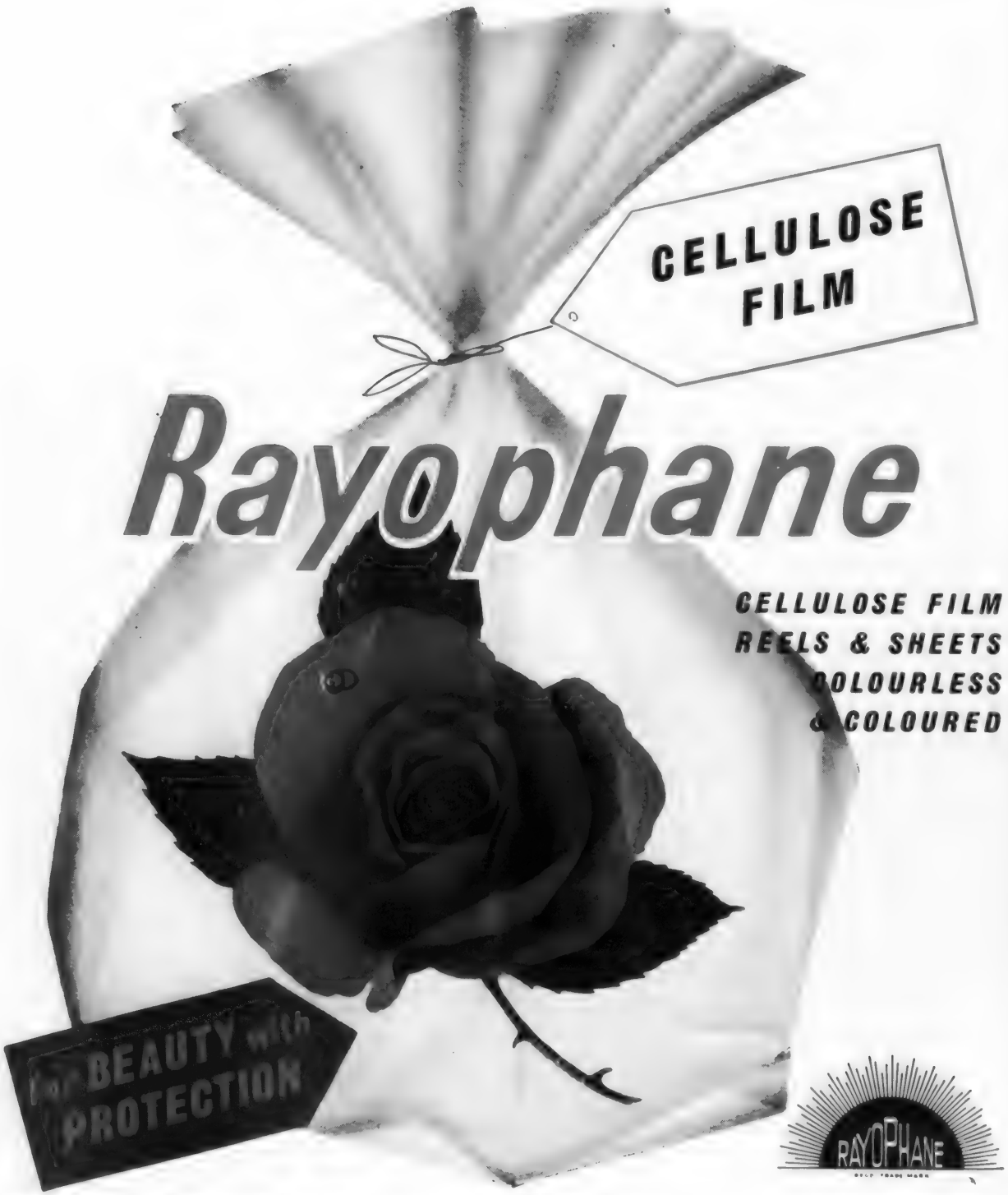


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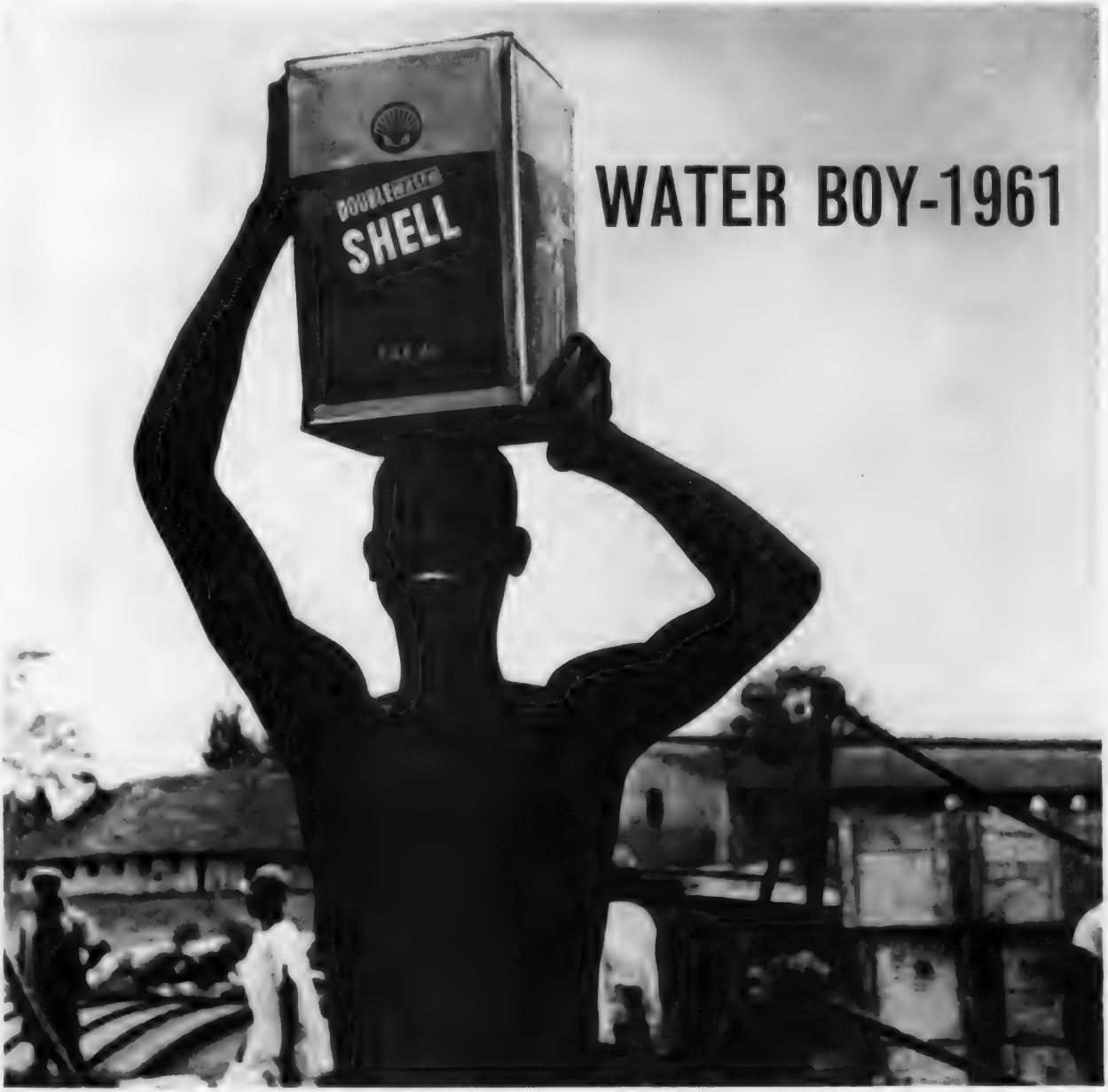


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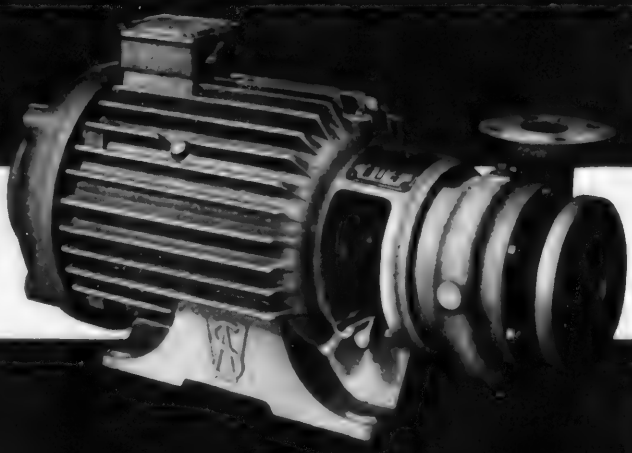

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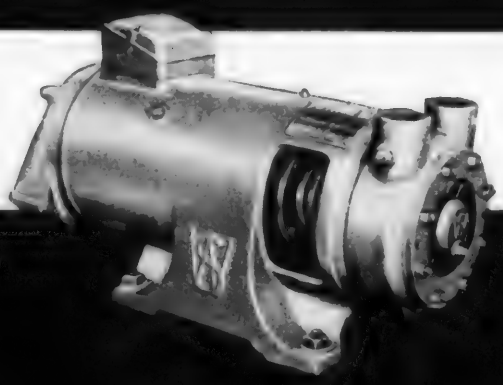

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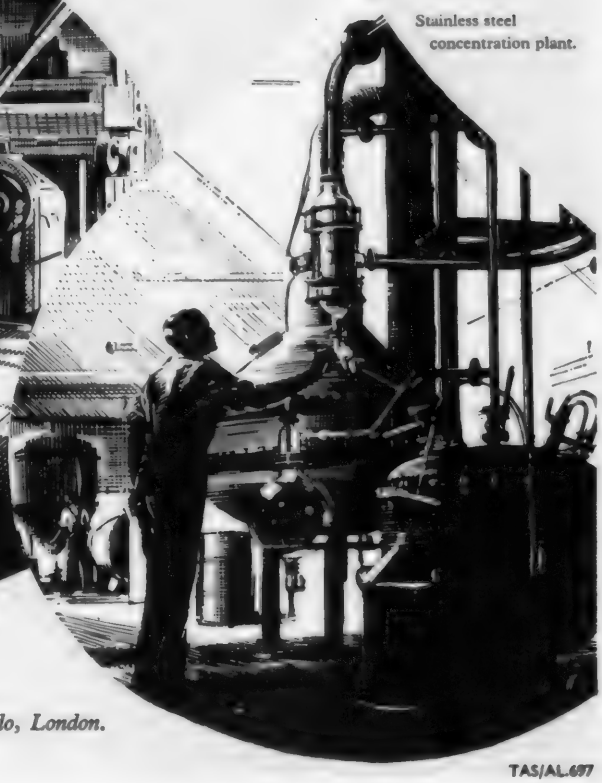

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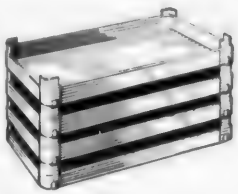

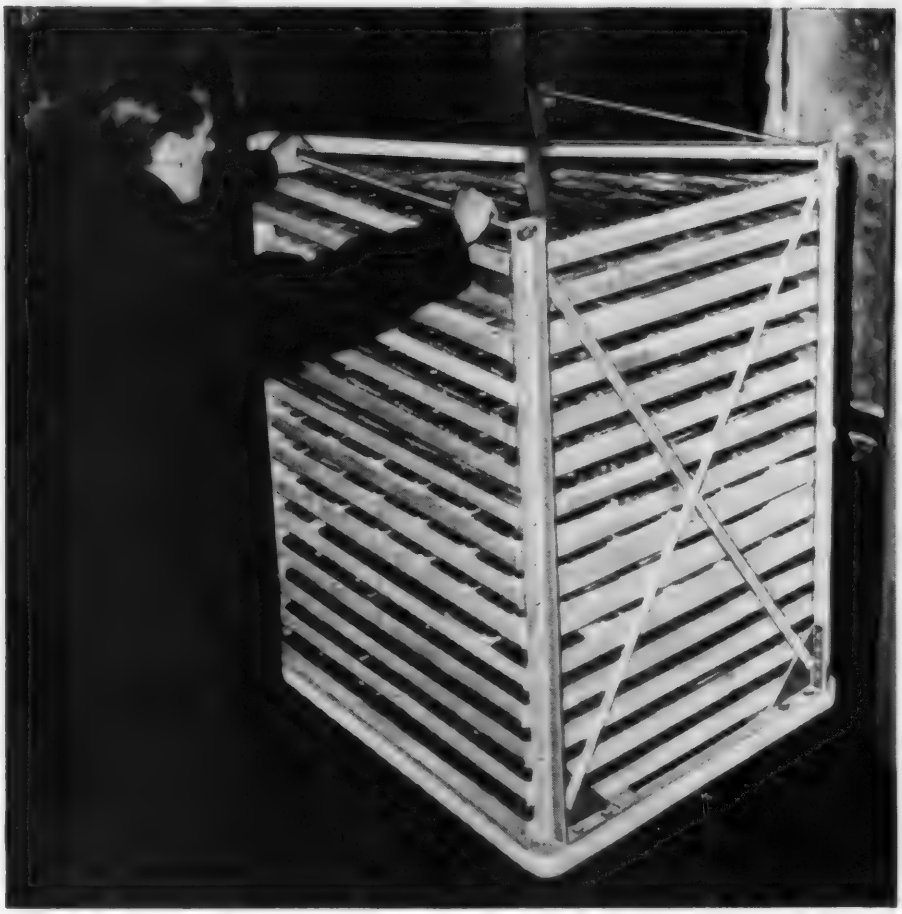

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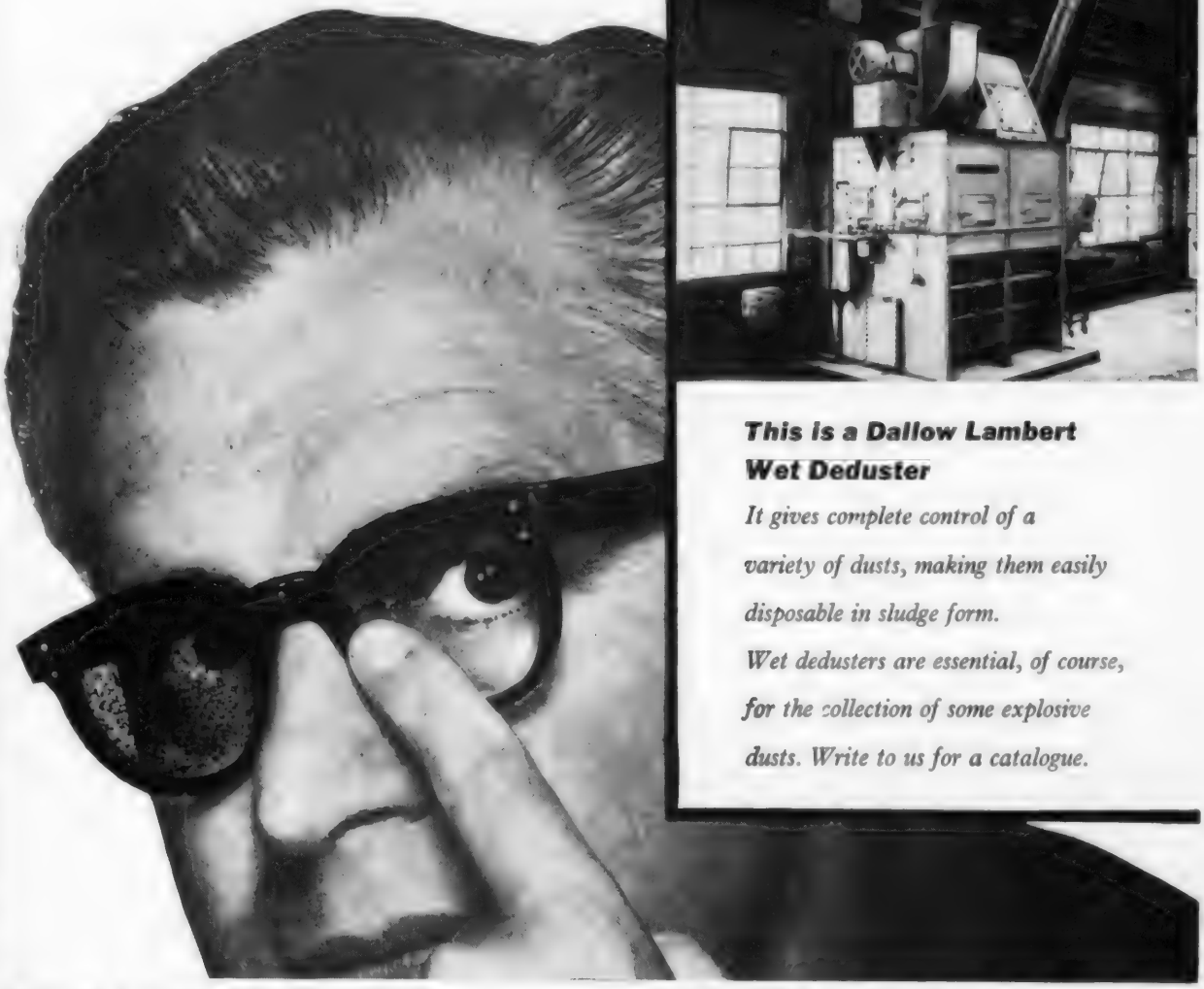

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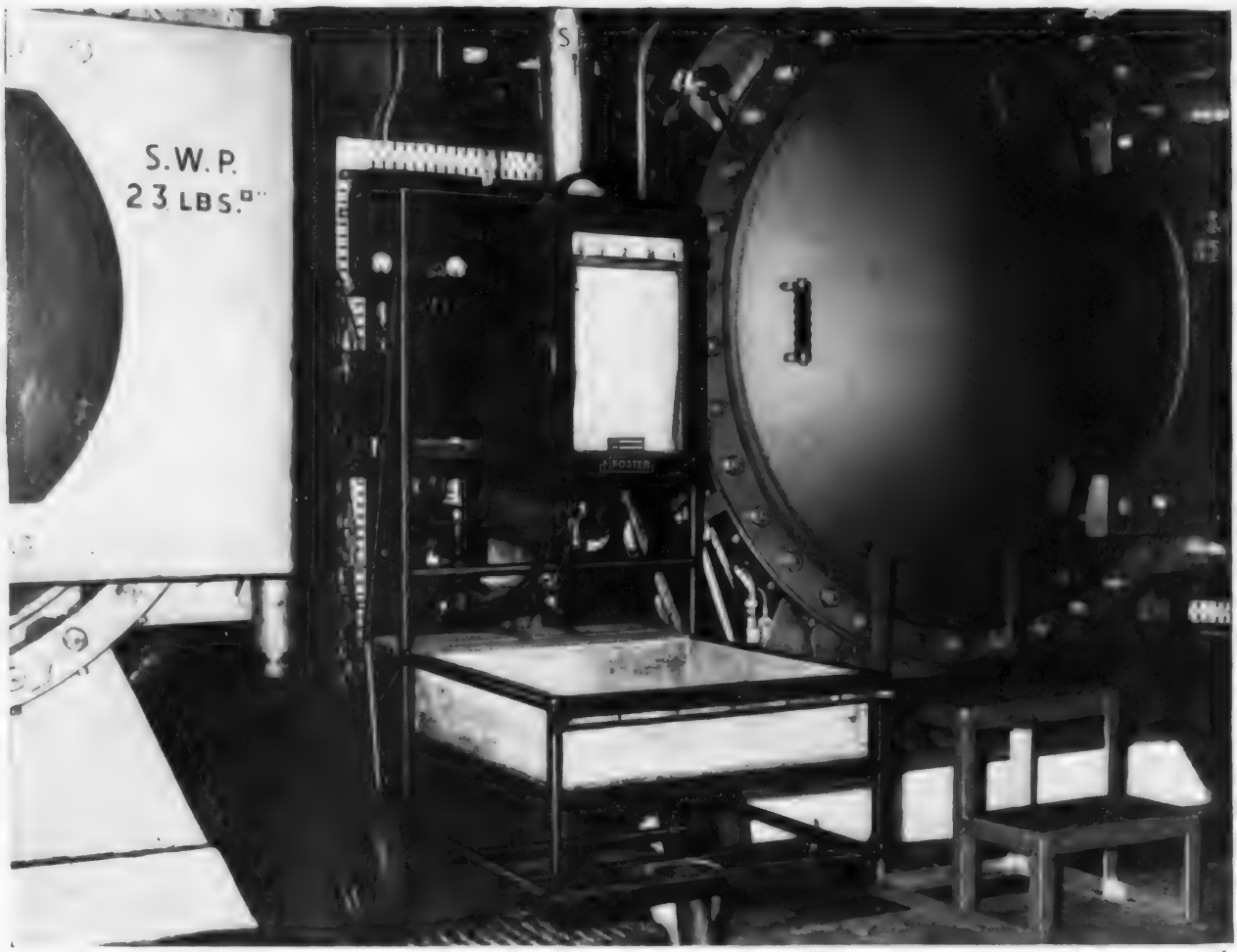


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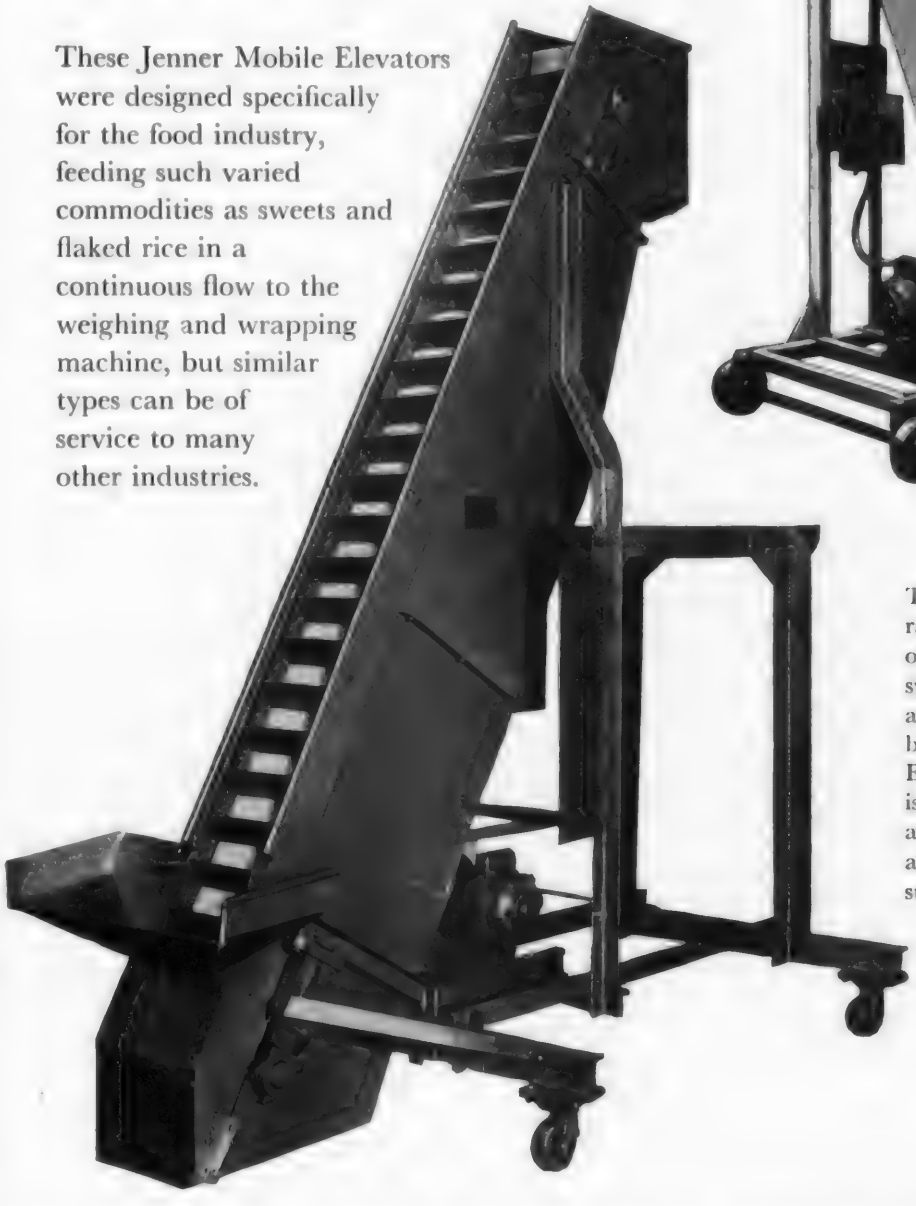

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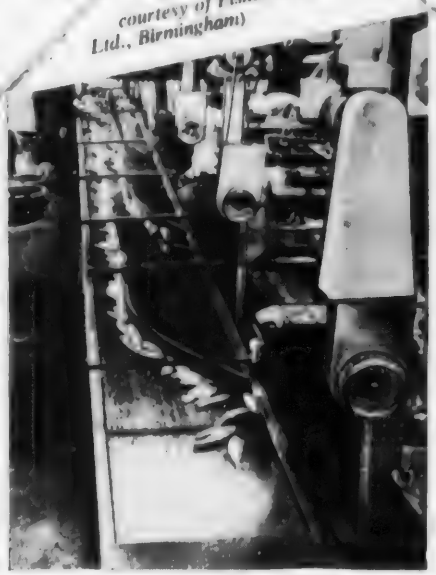
*Cake packing on a 'Motaveyor' (by courtesy of Knightsbridge Cake Limited, Manchester)*

*Fruit bottling on a 'Motaveyor' conveyor (by courtesy of J. Mawdsley Ltd., Wigan)*



*Scandura conveyor in a fish canning factory (by courtesy of Fisher & Ludlow Ltd., Birmingham)*

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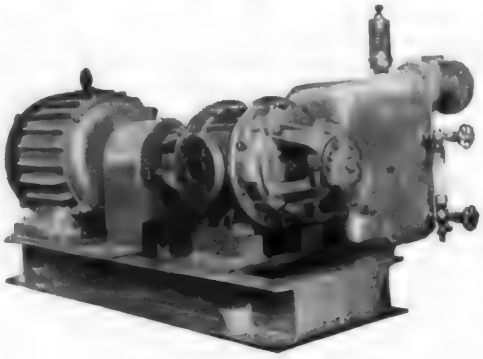

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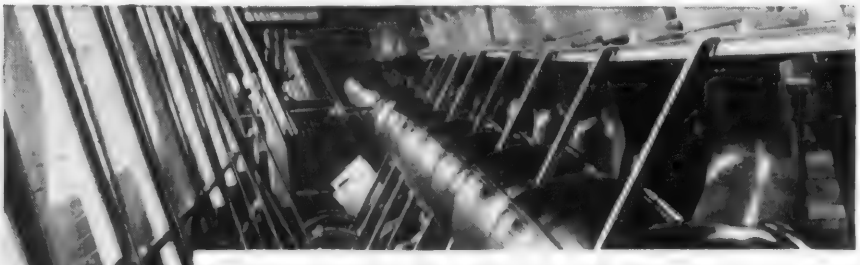

The sugar panning process shown above demands belting capable of continuous running at carefully maintained speeds for long periods. Turners flat transmission belting is used for

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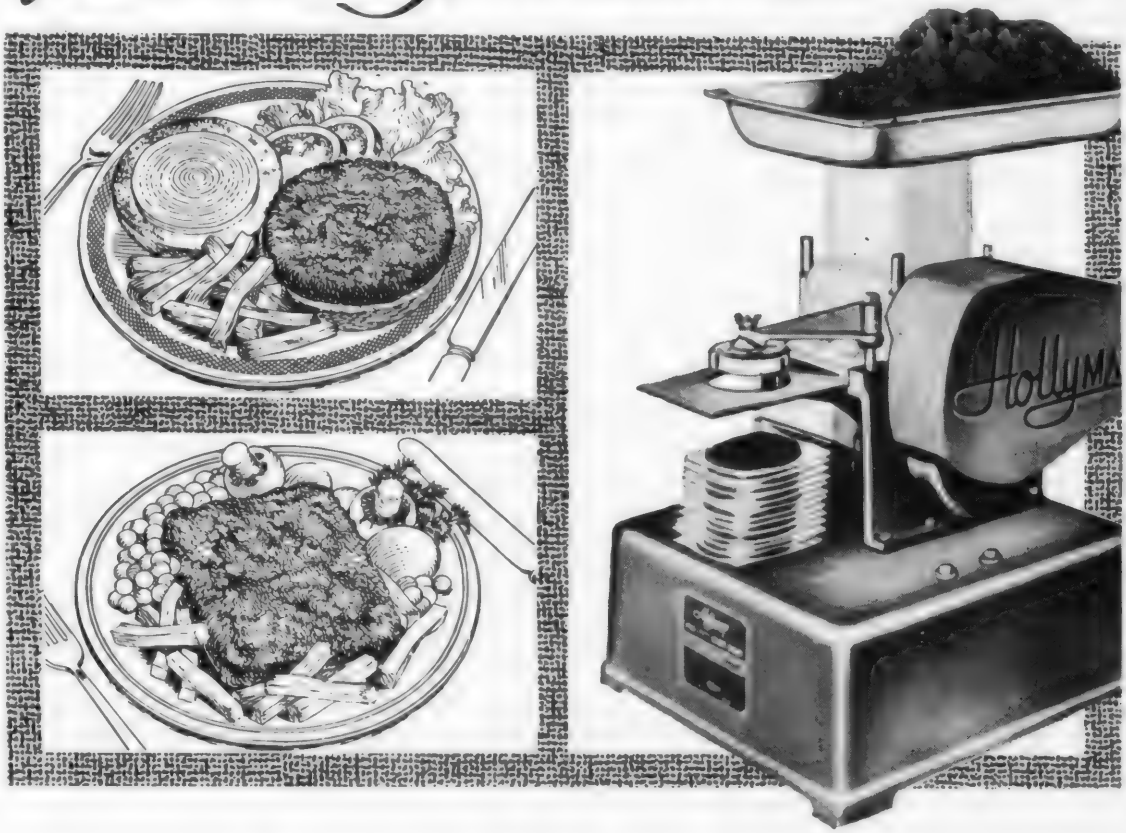


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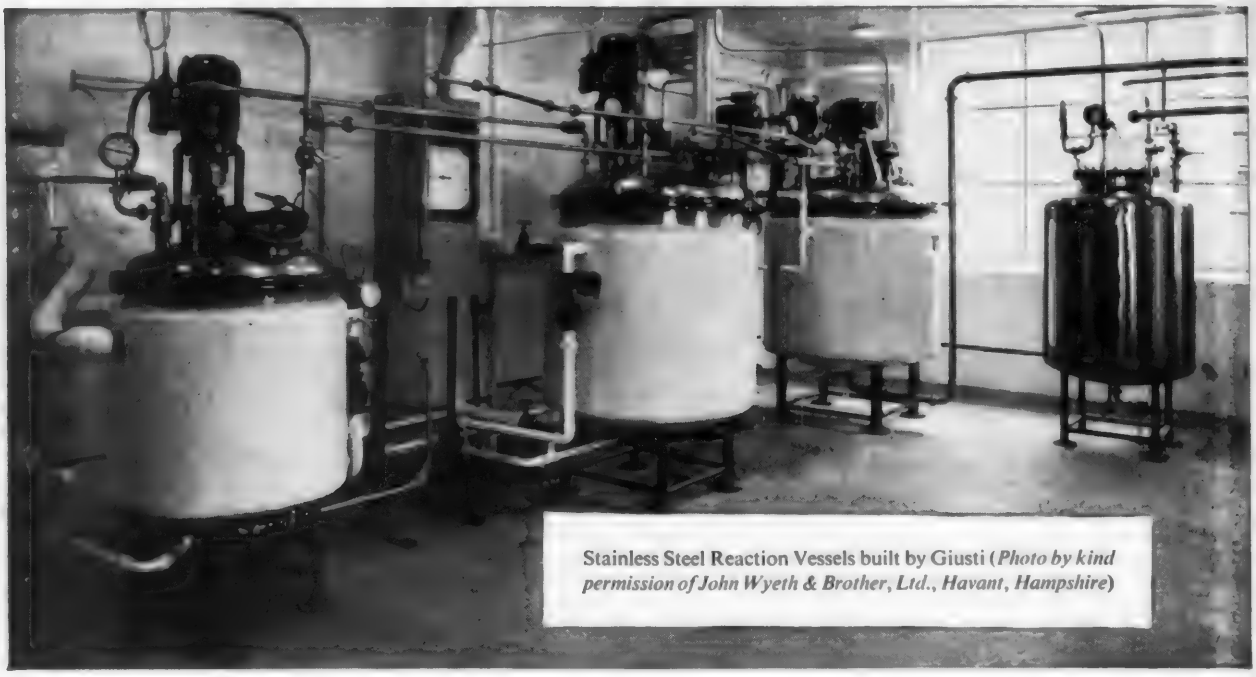

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A recent photo of stainless steel sterilizers made by Giusti and supplied to the M.W.B. Bacteriological Laboratories 25 years ago. (*Photo by courtesy of the Metropolitan Water Board*)

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# *FOOD Manufacture*

Volume 36. Number 2 Editor: Anthony Woollen, B.Sc. A.R.C.S., A.R.I.C. February 1, 1961



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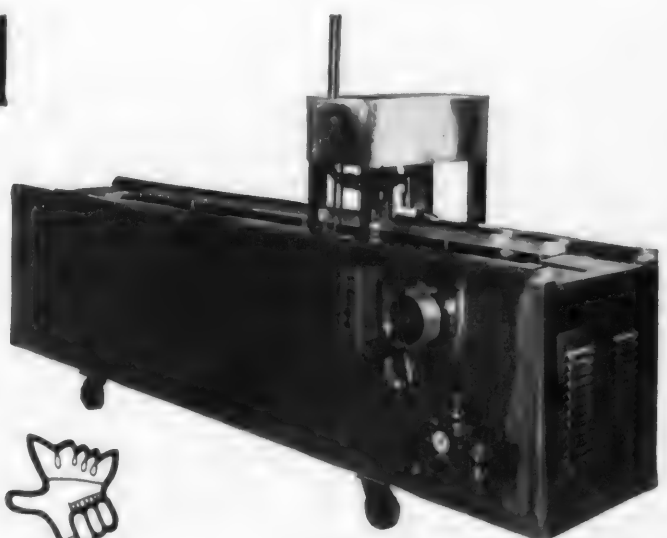

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FOOD
Manufacture

Vol. 36, No. 2 February 1, 1961

## *The prospects for A.F.D.*

COMMERCIAL possibilities of accelerated freeze-drying—A.F.D. for short—are at the present time rather an unknown quantity, but a lot of people are entertaining very great hopes and not a few are putting quite a lot of money into this technique of food preservation. First in the commercial field on this side of the Atlantic are, rather surprisingly, the Irish Sugar Corporation, whose plant at Mallow, shortly to come into operation, is under construction by Vickers-Armstrongs (South Marston), Ltd. Many eyes will be watching developments at Mallow; many firms, while discreetly pushing ahead with their own investigations, are adopting a "wait and see" attitude, and in view of this the Irish Sugar Corporation's decision to take the plunge is daring.

Biggest unknown factor at the present time—and the one by which A.F.D. will stand or fall—is cost. Present experience is that the process is more costly than other methods of dehydration, but experience also teaches that the more a process is commercially exploited the more costs come down. In this respect A.F.D. is unlikely to be an exception. There are also technical snags to be overcome. The process is still too much in its infancy for a sure decision to be made on which of the several technical approaches to the subject will offer the greatest economies; much will depend, of course, on the resources of the site, and the Irish Sugar Corporation's decision to use hot water heating and steam ejection has naturally been dictated by the fact that they have an abundance of steam at the plant.

Eventually, some form of continuous process will undoubtedly have to be developed if the technique is to be made really attractive, and for this radiant heating as opposed to the present plate heating method would seem to have the greatest chance of success.

How will the frozen food interests react if A.F.D. catches on in a big way? Will they compete vigorously or will they co-operate? In our opinion the second is more likely, in spite of the heavy capital outlay already invested in refrigeration equipment in the distributive chain. In the first place it may well be that freeze-dried and frozen foods will be complementary rather than competitive, some foods being more suitable for one technique and some for the other; and in the second place, as food has to be frozen anyway before being vacuum dried, firms supplying frozen foods may well be able to use existing freezing installations if they wish to install A.F.D. plants.

Undoubtedly a big potential market for A.F.D. foods is in countries without a well-developed frozen food industry.

## *Proper processing is key to food problem*

THE FACT that if wastage of the world's food were eliminated the world's starving millions could be fed was strikingly emphasised recently by Dr. A. L. Stahl of Miami University, who has spent a year in India as an F.A.O. technologist. He made the startling statement that one-third to one-half of all vegetables and fruit harvested in India are now lost through poor handling and marketing methods, and that much of the present grain stock is lost to insects, vermin and decay as a result of poor storage and transportation.

It is evident from reading the F.A.O. report that what is needed in India, and presumably in other under-developed countries, is a reorganisation of food processing and handling methods so that wastage is eliminated and more effective use made of available labour. To achieve this, much more mechanisation *in the right places* is needed. Mechanisation in the wrong place can make things worse, and Dr. Stahl cited a processing plant for oranges whose very modern juice extracting and concentration equipment was working at only a fifth of its capacity because the fruit were weighed, washed and conveyed up three storeys to the extractor by hand.

One of the obstacles to change is the Indians' conservatism in eating habits, and the average Indian's insistence on demanding all his fruit and vegetables fresh from the market every day means that everything is rushed to the market but only a half to a third of it is actually sold. With proper processing the rest could be saved.

In ten years India could have a major food processing industry, for which she already has the food

technologists and the businessmen. Better varieties of fruit and vegetables would double the farmer's output, and with a sound food processing industry India could become a food supplier for the rest of Asia.

## *Trappist monks and heart disease*

A STUDY, reported in *The Times*, of the relationship between the diet of Trappist monks and the incidence of coronary disease among them seems to indicate that although the monks, whose diet contains much less animal fat than normal, have a much lower blood cholesterol concentration than the average Western adult, they are just as prone to cardiovascular degeneration and arterial hypertension.

So where do we go from here regarding the theory that a high blood cholesterol content, allegedly the result of eating too much or the wrong kind of fat, leads to coronary trouble? The answer must be, as referred to several times previously in these columns and becoming increasingly to be realised, that no such simple relationship exists.

The monks form an ideal subject for study because here we have a closed community of men living a completely unsophisticated and simple life, untouched, as far as is possible, by the bustle and stress of modern living and who eat a meagre and carefully regulated vegetarian diet almost entirely produced by themselves. The study was made on two communities of Cistercian monks in Kentucky and Massachusetts and on a group of men in Cleveland, Ohio.

The daily life of the monks begins with choir and prayers at 2 a.m., followed by breakfast at 5.30, work in the fields or classes for students from 7.45 to 10.45, dinner at 11.30, afternoon work from 1.30 to 3.30 p.m., supper at 5.15 and retirement at 7 p.m. in winter and 8 in summer. Their daily diet includes ¾ quart of milk, a little cheese and butter supplemented usually with cottonseed oil, but contains no meat, fish, fowl or eggs. The diet is thus very low in animal fats and examination of the monks' blood showed that the average cholesterol content was much lower than that of the group of healthy men of similar ages in Cleveland. Yet the results of the study suggest, it is reported, that arterial hypertension is more frequent among the monks than among other men of the same age in the American population.

These results are, however, hardly likely to ruffle in the slightest the serenity of these dedicated men, who in silence and contemplation (how much better the world would be if we weaker mortals emulated in even the faintest degree their iron self-discipline) prepare themselves for the fuller life.

## *A.F.D. and the consumer*

ONE of the biggest disadvantages from the sales angle of the A.F.D. foods that we have seen is their unattractive appearance. No matter how well a dehydrated food reconstitutes when treated with water, in its dried state it looks shrivelled and unappetizing. Even more emphasis, therefore, will be placed on the packaging material and the method of presentation.

Both functionally and aesthetically the requirements for an A.F.D. pack are formidable. To achieve the outstanding virtue of A.F.D. foods, very long storage life, vacuum or gas packing will be necessary in the majority of cases, and packaging films of outstanding moistureproof qualities will be required. These of course exist, but the development of A.F.D. on a commercial scale will undoubtedly cause an intensification of research into even better packaging materials than exist at present. If A.F.D. also stimulates pack designers to produce brighter and more attractive outsides to the packs it will have achieved a major success, for in general, British pack design is markedly below the standards set by some Continental designs.

## *To pamper or not to pamper . . .*

IT IS reported from Sweden that pampered cows yield more milk than unpampered ones. A milkmaid at a school of agriculture near Stockholm lavishes affection on five cows in her charge; five others, identical twins with the first five and kept under the same régime of food, accommodation and milking technique, receive " humane but impersonal " treatment. The result, according to the *Daily Telegraph*, is that the loved ones yield an average of 20% more milk than the unloved. The biggest difference, it is said, has been 38 lb. of milk a day from a petted cow and 22 lb. from her unpetted twin, a difference of more than 70%.

If this report is substantiated by solid evidence, the results may show that even on scientific considerations alone, domestic animals cannot be regarded merely as converters of vegetable protein into human food. Although much study is being devoted to the efficiency of such conversion under a variety of controlled conditions, the assumptions that such studies involve, namely, that by suitably adjusting the physical environment, optimum production of the desired animal product may be achieved, may not be entirely valid.

Someone of course will ask the obvious question, what about broilers? Or, for that matter, what about battery beef? Here we are back again into the

dreary controversy between those who think Mother Nature knows best and those who think her methods can be improved upon. We do not intend to plough yet again that sticky furrow and get bogged down in a controversy which, influenced as it usually is by emotion rather than reason, is unlikely ever to be satisfactorily resolved. We can, however, refer to a minor side-reaction of the main issue, which is that exclusive preoccupation with material considerations alone breeds an arrogant and false philosophy towards those things over which man has no control, and over which, by their very nature, he is never likely to.

This false philosophy is revealed by the jargon in which it is expressed, the choicest example of which occurred in a recent press handout from a firm of turkey packers; the handout described an experiment to find out if turkeys can be satisfactorily stored in deep freeze for several years, and said that for the experiment a turkey had been selected at random "off the assembly line." We do not know if the writer was merely trying to be funny or whether he had got the publicity vocabulary of turkey packers and car manufacturers slightly mixed. Whatever the explanation, we resent God's creations being debased to the level of man's.

## *What food does to some people!*

"THE cold has been nearly killing us," said a man accused of receiving £3,000 worth of frozen meat and storing it in his children's bedroom. The endothermic property of the meat proved his undoing; it lowered the temperature of his dwelling so much that "we were worried about the kids," he is reported as having told the police.

## *She didn't know*

WHEN Mrs. Joyce Butler, Labour M.P. for Wood Green, asked in the Commons recently what action the Government were taking to prohibit the use of suspect food preservatives and colouring materials until they had been proved harmless, she got the reply that the Preservatives in Food Regulations and the Colouring Matter in Food Regulations already prohibit the use of all preservatives and colours except those specifically authorised for use in food.

We do not expect the members of our chief law-making institution, democratically chosen as they are from among the common people, to be omniscient, yet it is reasonable to expect them to be moderately well informed on matters affecting the people's daily lives. Considering the publicity which food has had lately it is indeed mildly astonishing how hard clings the belief, even among those who should know better, that food manufacturers are trying to poison us.

## *Grain fossae in Malta*

FROM time immemorial in certain countries, particularly those of the Middle East and central Mediterranean, grain has been stored in underground pits. In Malta the pits are known as fossae, and take the form of flask-shaped chambers with narrow cylindrical necks, hollowed out of the solid limestone rock. At the present time there are about 200 of these fossae, varying in capacity from about 50 to 500 tons, and all were constructed by the Knights of St. John during the years 1657 to 1660.

Although many are damaged, the bulk of the island's grain is today stored in a number of these fossae. It is believed that in earlier times the fossae were lined with a form of cement, making them reasonably waterproof and airtight; their openings were (and still are) closed with flat stone discs about 4 ft. in diameter. Today, because the cement rendering has worn off causing damp to seep through the walls, the pits are lined with straw as the grain is put in; this absorbs the moisture and prevents the grain coming into contact with the damp walls.

An interesting article in a recent number of *Tropical Science* describes some work carried out on the experimental waterproofing of one of the smaller fossae, measuring about 30 ft. deep and about 15 ft. in diameter, to compare its effectiveness as a storage container with that of an untreated fossa. One concludes that in their heyday the fossae must have been very effective storage containers for grain.

Grain was stored in both untreated and treated fossae for about six months (normal storage period is six to nine months) and compared. The grain from the treated pit, 68 tons of it, showed a little mould growth at the top and a few weevils confined to the top few inches; the 61 tons in the untreated pit were not in quite such good condition, although only half a ton was deemed as unfit for milling. About 11 tons at the bottom had a higher moisture content and a slight taint resulting from anaerobic fermentation. Weevil infestation was negligible.

One concludes that in days of old our forefathers knew how grain could be stored effectively, for there is no doubt that given adequate waterproofing (and slight seepage does no harm, for a little moisture is necessary for safe storage) the grain could be stored safely for months. It must be remembered that the untreated fossae had lost its original waterproofing and had been subjected to the ravages of 300 years;

a significant feature is the absence of infestation; an effective countermeasure against pests is to deprive them of air, for they cannot live in the absence of it.

## *Sugar's role in nutrition*

A RECENT leading article in *Chemistry and Industry* draws attention to a paper (Chain *et al., J. Phys.*, 1960, **154**, 39) describing a study of carbohydrate metabolism in the intestines of experimental animals. This and other work suggests that different sugars play different roles in nutrition and that carbohydrates are not necessarily interchangeable. The commonly held view that dietary carbohydrate merely supplies needed calories is generally being discarded by nutritionists.

The most recent studies indicate that protein and fat metabolism is profoundly influenced by the kind of carbohydrate ingested. It appears, for example, that "maize dextrin spares protein more effectively than sucrose when fed to animals on a low nitrogen intake. . . Lactose increases intestinal absorption of cholesterol in the rat. . . Chickens fed sucrose in a diet containing 3% cholesterol have higher serum cholesterol levels than those fed glucose and there are other reports which seem to connect high lactose intakes and atherosclerosis."

The relationship between protein, carbohydrate and fat in nutrition is increasingly seen to be more and more complex as knowledge increases. This makes very difficult the task of the publicity agent trying to wring out the last drop of medical evidence in favour of A's vegetable fat or B's glucose-containing soft drink; in fact, the poor fellow hardly stands a chance and would be strongly advised to give up the unequal struggle.

## *Threat to food prices*

TRUST the National Farmers' Union to clamour for increased import duties on food. They are applying for increases ranging from 133% to 366% on the present duties on new potatoes during the first half of May and the month of July. If the applications were granted the rate of duty could go up from 25% to 60%. This would make things rather hard for manufacturers and fish fryers who require Belgian new potatoes in July.

Most people like money and we have every sympathy for those who for reasons outside their control find they are not getting as much of it as they are accustomed. But we do not think that the right way of remedying this state of affairs is to rush to the Government like a spoilt child and demand the imposition of tariffs, restrictions and other artificial constraints. If imported goods are cheaper, the first thing to do is to find out why. If the reason is that foreign growers and manufacturers are using more economic methods, the correct course of action is to put our own house in order.

Such situations may, of course, not be quite so simple. Foreign interests may be using labour whose cheapness would not be tolerated here; their Governments may be subsidising exports at the expense of their home consumers. But the National Farmers' Union cries "wolf" so often that those who view its demands for Government aid rather critically may be pardoned.

## *Better times for biscuit makers*

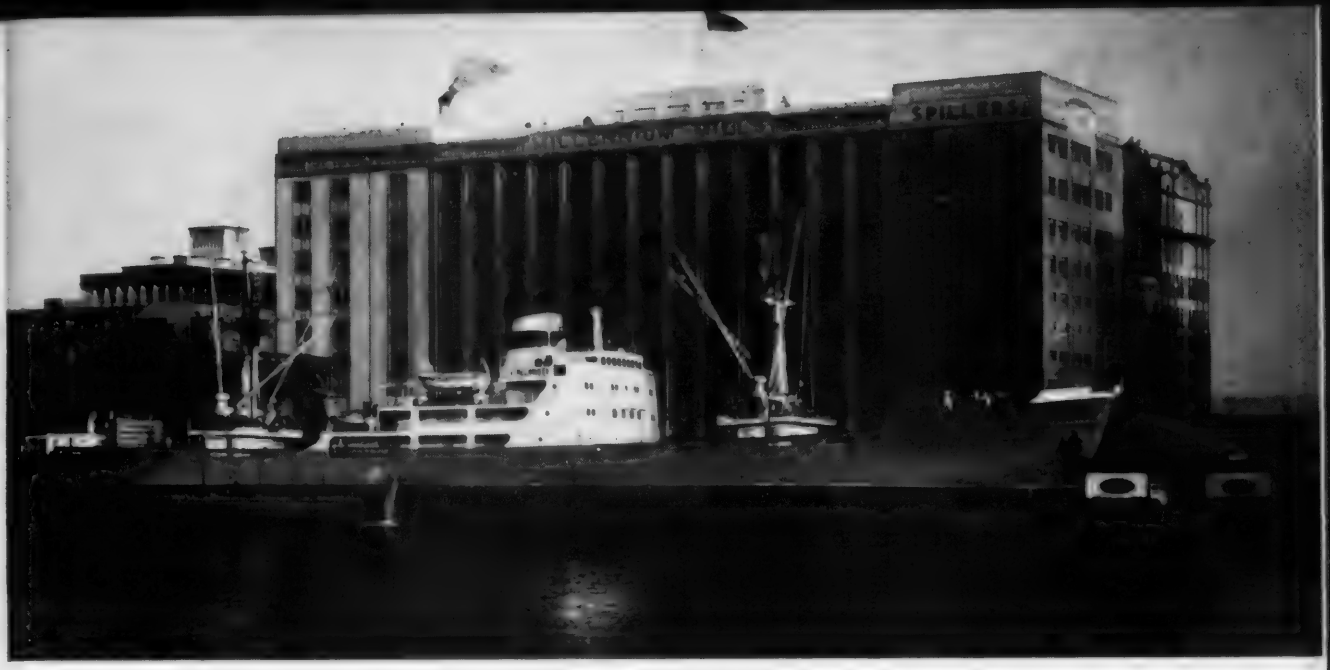
AFTER a steep drop in biscuit sales in 1959, 1960 appears to have been a record year for biscuit sales. Coupled with the parallel rise in confectionery consumption, sales of which had likewise taken a depressing plunge, this indicates better times ahead for biscuit and confectionery manufacturers, who have been spurred to increase advertising expenditure during recent months. Keeping the leadership in this fickle market is a difficult business, and it is interesting to see how novel and successful lines gradually drop out of favour after a few years as imitators enter the field with similar lines and as the public taste hungers for fresh novelties.

The moral in this is that no company, however successful it may be, can afford to sit back and relax. No product stays a winner for ever.

## *Instant beer*

MEMBERS of the Ancient and Honourable Order of Froth Blowers will view with alarm the latest technological invention which threatens to cross the Atlantic from the U.S.A. It is reported that a subsidiary of the Union Carbide Corporation has produced a beer concentrate one-quarter of the volume of ordinary beer from which the water and $CO_2$ have been removed. It is said that this concentrate, produced in a central plant, is intended to be shipped all over the country and to be reconstituted in Government licensed plants and made available to the public.

On March 21 the U.S. Treasury Department will hold a public inquiry to decide whether the reconstituted product will have substantially the taste, aroma, colour and other characteristics of such beer before concentration. It will then decide how the product is to be taxed and labelled. Froth blowers may consider the whole matter a bitter thing to swallow.




# Spillers' Millennium Mills

## *Re-equipped flour plant produces 850 tons/day*

**These modern mills on a 4-acre site in the heart of London's dockland were rebuilt since the war and have been extensively re-equipped in recent months. This exclusive article reviews modern flour-milling practice and describes a recent visit to these mills.**

THERE are as many kinds of wheat as there are wheat products, and blends of wheat flour for many purposes. For bread-making the hard wheats of North America are, generally speaking, more suitable than the softer wheats of Britain, which usually give flours having properties more suitable for biscuit, cake and confectionery manufacture and for domestic purposes. Nevertheless, in practice bread flours usually contain a proportion of English wheat and cake flours a proportion of North American.

Between what the flour user wants and what is available a balance must be struck. Wheat quality and properties vary from country to country, from year to year, and shipment to shipment. The user's requirements are with certain exceptions eternally the same, but the nature of the raw materials varies within wide limits.

Formulation of blends to provide the properties the customer wants with the material the miller has available is therefore a matter of great skill and judgment, but increasingly the miller's art is being assisted by the resources of science, and the ability of the cereal chemist to measure many elusive properties of flour with a precision unknown only a few years ago greatly assists the attainment of the present-day miller's principal goal, which is to maintain the uniformity and predictability of his various blends.

### Traditional milling practice

Present-day milling practice, at least in this country, does not differ in principle from the techniques developed in the later decades of last century, but the process has naturally been refined and speeded up with the development of efficient high-speed machinery. With increasing mechanisation, outputs have gone up while the labour force has gone down. At Spillers' Millennium Flour Mills, for example, which has a throughput of the order of 850 tons/day, only 18 men per shift are required for production, of which only 13 work on the milling floors of the two plants.

*(Above)*: **Millennium Mills at Royal Victoria Dock, Silvertown, with the Russian ship "Ilia Mechnikov" discharging grain.**

### Pneumatic handling

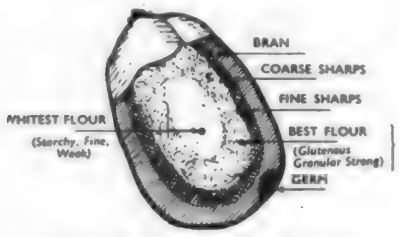
The greatest single technological advance in recent years has been the development of pneumatic bulk handling, which enables large quantities of grain and milled products to be transported from ships' holds right through the various processes more efficiently and cleanly than with bucket elevators and conveyors.

The fact that this country imports the bulk of its wheat from all over the world means that British millers have at their disposal many more kinds of wheat than have the millers of self-sufficient countries such as the U.S.A. Millers here, therefore, have the added problem of using a wider selection of wheats, and consequently the British miller must

have a unique knowledge of blending to obtain flours of necessary strength coupled with colour, flavour and good milling yield.

**New developments**

In the U.S.A. and Canada, where available varieties are fewer, greater emphasis is coming to be laid on methods of classification rather than blending. These are based on the fact that flour particles of different sizes have different compositions. There is, for example, the phenomenon known as "protein shift," in which the protein content of the smallest particles, up to 15$\mu$, have a value considerably greater (ca. 15-20%) than that of flour as a whole (8-14%), while particles in the intermediate range (15-35$\mu$) have a lower protein content (ca. 5%) than the flour as a whole. As particle size increases above 35$\mu$ the composition broadly approaches that of the average for the flour.




**Section through a grain of wheat.**

Altering the composition of a flour by a classification of particles, although commercially in its infancy, may well be the next major technological development in flour milling.

**Essentials of milling**

The essentials of the milling process are as follows:

1. cleaning, washing and drying of the wheat;
2. conditioning of the wheat;
3. blending and milling;
4. sifting and grading by size; the broken wheat is graded into a coarse "break" stock, semolina, middlings and flour; the "break" stock is remilled and more semolina, middlings and flour extracted; this process is repeated so that altogether the grain goes through four breaking processes;
5. "purification" of the various semolina and middlings fractions;
6. reduction into flour by smooth rollers.

Addition of bleaching agents, improvers and other additives (such as vitamin B, nicotinic acid, iron and creta præparata, the last of which must by law be added at the rate of 312 mg./100 g.) is carried out after the final reduction to flour and before the flour is packed.

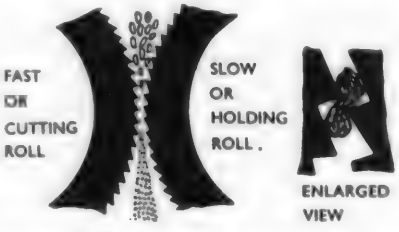



**Diagram of the milling process, showing the shearing action of fluted rolls on grains of wheat.**

**The washing plants; each of the six streams of wheat grouped according to their native characteristics (hard, medium, soft) falls into the washer tank where under the violent agitation of the washing worm conveyor all dust, mud, etc., is removed. Duration of immersion in the washing worm can be varied by selection of any one of three points of entry for the wheat. Metal, stones, sand and grit sink below the washing worm and a second smaller worm conveyor running in the reverse direction delivers this material to a special chamber. Dirt, light impurities and fragments of wheat skins are floated away from each washer tank which is constantly replenished with chlorinated fresh water.**

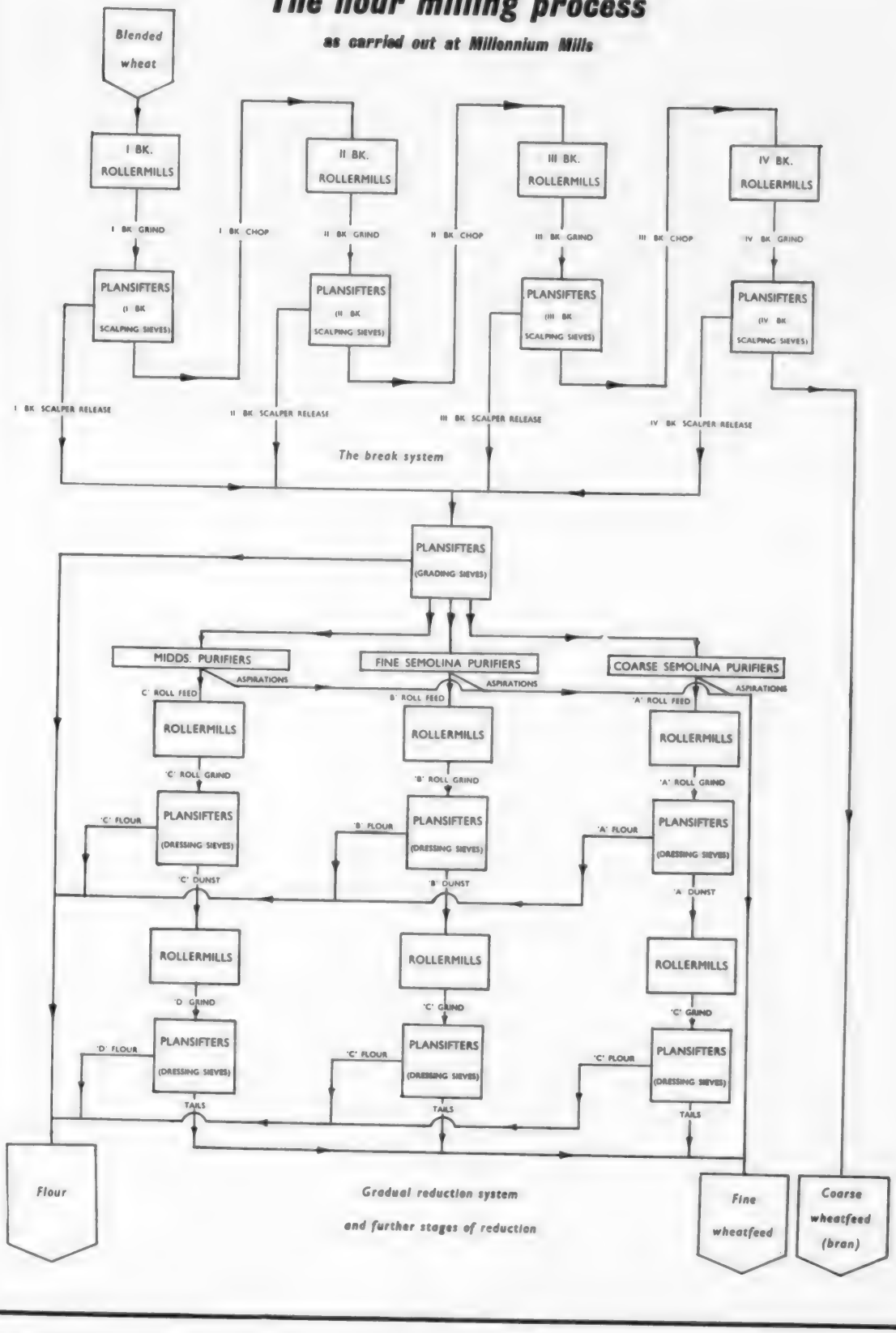
The main object of the milling process is to separate the flour constituents of the grain from the husk without grinding the various constituents into an intimate mix impossible to separate. This is achieved by a gradual breaking down in a succession of fluted roller mills, each mill successively reducing the grain.

Each roller mill comprises two pairs of horizontal rollers, the upper and lower roll of each pair rotating in opposite directions at a differential speed of $2\frac{1}{2}$ to 1. The rollers are fluted in the manner shown in the diagram; the flutes do not run exactly parallel to the axis of the roller but are slightly spiralled, in the manner of a rifle barrel.

The process is literally a breaking of the grain and a release of the contents, which are subsequently separated by sifting. It is desirable at this stage to make as little flour as possible, and to achieve as clean a break as possible into "break" stock, semolina, middlings and dunst. These

# The flour milling process

**as carried out at Millennium Mills**



(*Left*): "A" Mill roller floor with the "break" rolls in the foreground. The wheat is first broken open by fluted steel rolls on this floor, then elevated pneumatically to the seals floor where it falls by gravity to the plansifter floor. (*Right*): "B" Mill plansifter floor. Plansifters are sieving machines of high capacity containing tiers of nests of sieves. Each tier is divided into several groups of sieves of different mesh enabling the stock fed to each section to be separated into various particle sizes, the finest particles being flour and the coarser particles, sub-divided as required, going to the subsequent break and reduction stages as appropriate.

are not distinctive materials, but simply names given to parts of the broken wheat grain of certain accepted sizes.

The small amount of flour that is produced at this stage is not regarded as of the highest quality, although it is of course separated off in the plansifters and blended with other machine flours as it is conveyed to the storage bins for subsequent packing and delivery. The bulk material that comes from the break roller mills is called the "break chop." Altogether the grain passes through four separate breakings, and the semolina, middlings and dunst from each break are "purified" and passed to reduction roller mills for gradual reduction to flour. These reduction roller mills are similar to the break roller mills, but the rollers are smooth and rotate at a differential speed of 1¼ to 1.

Under this system the amount of flour made is 70 to 80% of the cleaned wheat, the remainder being bran and offal.

## MILLENNIUM MILLS

Spillers' Millennium Mills at Royal Victoria Dock, Silvertown, have the peculiar distinction of having been destroyed and rebuilt twice since the time of their original construction by Messrs. W. Vernon and Sons in 1905. The first destruction was in 1917 when the nearby explosive works of Brunner Mond and Co. blew up. Only the silo remained intact. The mills were rebuilt in 1920 and until their destruction by bombs in September, 1940, were regarded as the finest mills in the country. During the last war, no less than 22 bombs fell on the site, the original silo built in 1905 also being destroyed.

Reconstruction began in 1947 and was completed in 1953. Among the new features incorporated were: pneumatic elevation and conveying of grain and mill products; bulk storage of mill products; high-speed packing of mill products on day shift instead of on three shifts (the mill itself is still operated on a continuous three-shift basis); and mechanical handling of all mill products on pallets.

Part of the mill site is occupied by an animal feed mill, not within the scope of this article, which utilises many of the by-products of the flour mill. There are two mill sections, A and B, and during 1960 B mill was extensively re-equipped with new machinery, making it among the most modern flour milling units in the country.

### Intake and storage

The mill site adjoins a jetty of the Royal Victoria Dock, where grain ships up to 10,000 tons capacity are moored and their cargoes discharged direct to the grain silos. On the jetty are two travelling pneumatic intake plants each with a capacity of 150 tons/hr. Pneumatic suction is provided by two pairs of reciprocating pumps housed on the ground floor of the main block and connected by pipes to two chain conveyors running under suction and extending the full length of the jetty. Connections can be made every few feet along these conveyors to the suction pipes of the travelling intake towers which can be moved to suitable positions for working any hold in a ship lying alongside.

In a pit at the end of the jetty are two tippers, where the suction is broken and the grain fed through hoppers and elevators to two chain conveyors on a bridge into the receiving house. After being weighed in two 2-ton automatic weighers and passed through two rubble separators, the grain is fed to the concrete storage bins by conveyor bands on top of the bins. There are also intake points for English grain delivered in bulk or in sacks by road or rail.

There are three sets of reinforced concrete silos, A, B and C (the last dating from 1934 and used mainly for coarse grains for the adjoining animal feed mill). All are fully interconnected and their total capacity is 36,000 tons.

The grain is withdrawn from the bottoms of the bins on to five conveyor bands running above ground floor level. These take the grain

*(Left)*: **"A" Mill seals floor; six pneumatic systems comprising high and low pressure fans, numerous cyclones and suction filter dust collector units are required to " lift " the various ground mill stocks through the 120 penumatic pipes. A rotary seal delivers each stock separately to the appropriate section of one of the plansifters on the floor below.** *(Right)*: **"B" mill purifier floor. By means of a finely controlled combined sieving and aspiration, a very accurate separation of endosperm from branny particles is achieved. The semolina and middlings separated from the " break chop " at each of the four stages are graded into coarse and fine particles before purification.**

either to two 30-cwt. automatic weighers and thence to an intermediate silo, or if the moisture content of the grain is too high, to small bins feeding two Simon GM-type 6-ton dryers. From the intermediate silo the grain is drawn for cleaning, blending and conditioning prior to milling.

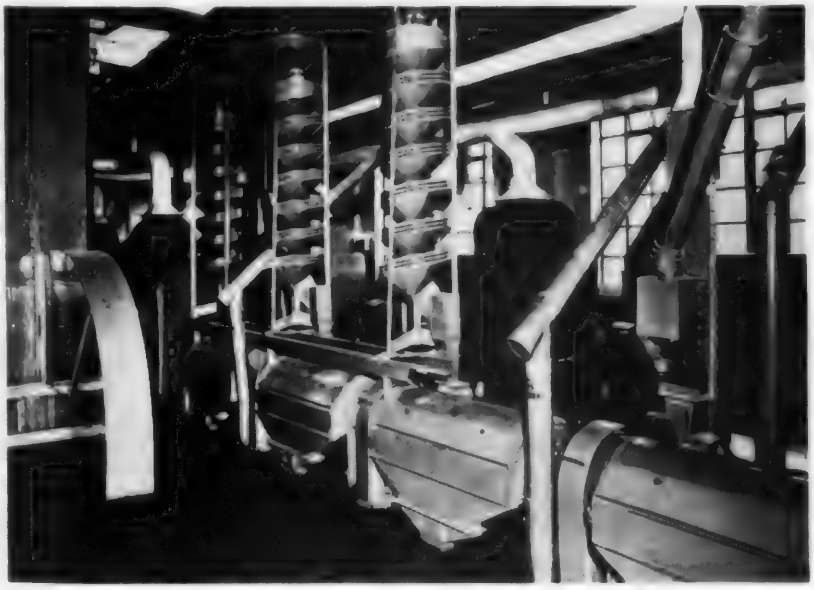
**Cleaning, blending and conditioning**

Under each bin in the intermediate silo there are Simon *Exact* measurers, where each type of wheat is measured by volume before passing along chain conveyors through the wall to elevators which take the various wheats to six primary cleaning plants consisting of millerators, grain cleaners or aspirators depending on the treatment required. Magnets in the spouting retain tramp iron.

A millerator is a totally-enclosed machine for removing impurities of larger size than wheat and also dust, sand and small seeds. It consists of two slightly inclined sieves one above the other, each of which is given a rotary motion at the higher end and an oscillating motion at the lower end. The upper sieve rejects stones, sticks, straws and seeds larger than wheat, while the lower sieve tails over the wheat but allows dirt, sand and seeds smaller than wheat to pass through.

The next operation is washing, which is carried out in a battery of Simon combined washers and whizzers; a whizzer is a centrifuge comprising a vertical cylinder of perforated metal having inside a vertical shaft carrying inclined beaters. Wheat from the washer is fed to the bottom of the cylinder, propelled upwards by the beaters and flung against the perforated cylinder, so that the surplus moisture passes out through the perforations. The washing process consumes about 16,000 gal./hr. of water. Stones and other dense material are separated by specific gravity and ejected separately from the lower section of the washer conveyor.

From the whizzers the washed grain passes either to (1) surface moisture dryers (designed by the company) each superimposed on a Simon GM dryer; (2) a surface moisture dryer only; or (3) direct to the primary conditioning bins, where the separate wheats remain from 4 to 20 hours depending on requirements.



**Spiral separators are shown in the foreground with disc separators immediately behind and farther back can be seen the wheat scouring machines.**

During conditioning the moisture content and its distribution throughout the grain becomes adjusted to the right degree for maximum efficiency of milling, and to enable the bran and endosperm to be separated easily. Generally speaking, the moisture content of imported wheats has to be increased (which is achieved during washing) and that of English wheats has to be reduced (hence, some of the wheat is dried after being washed).

**Blending**

Blending of the wheats is carried out before milling. From the primary conditioning bins the wheats are drawn to automatic electric weighers which operate according to a preset programme. The blends are made up in batches for each of the two mills, 700 lb. batches for A mill and 600 lb. for B; the interval between successive batches is 54 sec.

The operations of the weighers are synchronised to weigh the specified amounts of each wheat, and if for any reason a batch requirement cannot be met, *e.g.* if one of the conditioning bins becomes empty, the whole weighing operation automatically stops. Provided, therefore, that the weighing sequence has been correctly programmed, it is impossible for an incorrectly blended mix to be fed to the mills.

The blended wheat next goes to disc separators which separate other grains such as oats and barley, and mis-shapen grains; these are rotating discs having concentric pockets of such a size that the particular grain it is desired to remove lodges in the pockets and is flung out centrifugally. By passing the grain in succession through a series of disc separator units of different sizes, various unwanted constituents are removed, the wheat being either lifted from longer grains such as barley and oats, or smaller seeds lifted from the wheat.

Finally, the smallest wheat passes by gravity down a series of spiral chutes which remove black seeds of cockle which, being nearly spherical, move to the periphery of the spiral and are ploughed off.

**The spiral chutes down which the bags of flour pass through the lower floors to the bag spacing conveyors operated at each vehicle loading position. Two warehousemen are transferring 140-lb. bags to one of the chutes while a fork truck is arriving with another loaded pallet. The warehouse floors have been designed high enough for loaded pallets to be stacked three or four tiers high depending on the number and type of bagged, cased or packaged products.**

All the material removed in this way, together with bran and offal, goes to the animal feed mill for incorporation in animal feeds, or is sold as a by-product.

The blended wheat now goes to secondary conditioning bins where it remains for a specified time before going through the final cleaning process.

From the secondary conditioning bins the wheat is fed by Simon *Exact* measures to scourers, emery-lined drums in which the wheat is scoured and polished by beaters. Residual dust and beeswing is removed and aspirated off.

(Some wheats such as Manitoba do not need severe scouring.)

**Milling**

The wheat now goes to two sets of mill grinding bins under which are automatic weighers feeding the mill feed control units. Thence the blended wheats pass along worm conveyors over large magnets to the two mills, the larger mill, A, having a flour capacity of 100 280 lb. sacks per hr., and the smaller, B, of nine-tenths this capacity.

From this point on, the successive processes—namely, milling, purifying, plansifting, reduction and flour dressing—are carried out independently in each of the two mills, and it is convenient here to describe briefly the equipment in each mill.

**A mill**

All the break roller mills for the four breaking stages are Simon 60 in. type GC, of which there are 24. The scratch, reduction and offal mills are all 40 in. type GC, and there are 68 of these. There are thus 92 mills in all, accommodated in four lines on a floor 208 ft. long; one 11,000 volt motor drives the lot through four lines of shafting.

There are four machine floors, the roller floor just described, and in ascending order the purifier floor, plansifter floor, and seals floor. On the purifier floor are 33 Simon 18 in. double purifiers, 4 Robinson bran dusters and 5 Entoleters for flour hygiene control. On the plansifter floor are 10 Robinson plansifters on all the break stocks; the rest of the floor comprises 17 Simon *Flowmaster Plansifters* on all the reduction and scratch stocks. The top floor, known as the seals floor, is the heart of the pneumatic system, and there are two lines of groups of cyclones and seals, with the centre portion taken up by high and low pressure fans, together

**A group of the company's bulk delivery vehicles which deliver flour in bulk to large bakers, biscuit makers, etc.; 35% of the mill's output is now delivered in bulk.**

with Simon suction filter dust collectors.

**B mill**

This is almost identical in design, except that all the dressing is done on Simon *Seniorsifters*. On the roller floor are 9 60 in. roller mills and 47 40 in., a total of 56. On the purifier floor are 28 Simon double 18 in. purifiers.

**Purification**

The semolina and middlings which have been removed from the various break stocks are treated on machines known as purifiers. These consist of two tiers of reciprocating sieves cleaned by automatic brushes through which a current of air is drawn. The combined effect of the aspiration and sieving is to remove much of the loose branny material with which the stock may be contaminated and to grade the stock on the basis of particle size and also to some extent on purity (measured by the greater density of pure endosperm).

**Reduction and dressing**

The purified semolina and middlings are sent to smooth rolls known as reduction rolls, revolving at a differential speed of 1¼ to 1. There are 13 sets in each mill designated by consecutive letters of the alphabet from A to M. The crushing action of the rolls reduces the size of the nodules of endosperm in the stock, reducing some of them to the fineness of flour, and at the same time tends to flatten out branny and germy particles. The stock leaving a pair of reduction rolls is sieved, or dressed as it is called, on plansifters to remove the flour which has been produced by the rolls. The residue is separated into two fractions; the finer and purer of these goes to one of the succeeding reduction rolls, while the coarser and more branny material goes still further down the reduction system.

By the time the last reduction roll of the series has done its work most of the endosperm has been converted to flour and most of the coarser branny fragments have been removed. The residue is an intimate mixture of endosperm and fine branny matter from which it is no longer practicable to separate good flour.

The plansifters comprise nests of sieves (wire or nylon mesh covered according to size and duty) enclosed in a cubical container; there are 23 or more sieves per nest and 6 nests per machine. The container is given a rapid horizontal rotary motion by a vertical shaft from which it is eccentrically driven, the whole machine being suspended by four groups of canes.

**Dosage of additives**

Dosage of the various additives and improvers is made automatically from dispensers; these meter the additives into the conveying chutes feeding the flour into worm agitators. In the agitators the flour is mixed and the additives thoroughly incorporated.

Chlorine dioxide is made in a separate room and fed to the agitators by a dispenser which meters the maturing agent at controlled pressure.

**Packing and despatch**

Flour is despatched in packs varying in size from 1 lb. bags of self-raising and plain flour to 14 ton bulk tanker loads. At the present time about 35% of the mill's production is despatched in bulk, and it is the firm's policy, for obvious reasons, to try to increase this. Many bakers still receive their flour in re-usable sacks, but for reasons of hygiene non-returnable paper bags are increasingly being used. Space does not suffice to describe fully the variety of packing machines, both semi- and fully-automatic, used for the various sizes and kinds of pack.

There are 30 reinforced concrete bulk storage bins in the space between B mill and part of A mill, some for flour and the rest for wheat feed. Automatic weighers record the weights of mill products before they pass along the worm mixing conveyors over the flour bins and along the wheat feed conveyors. Each bin has a capacity of 50 tons of flour or 30 tons of straight-run wheat feed.

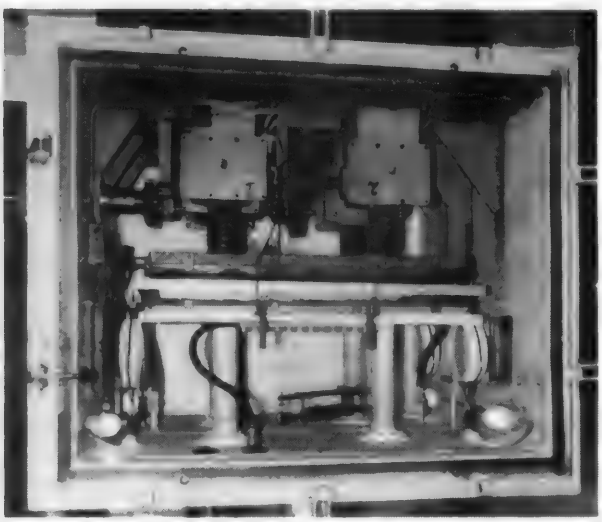
Steel hoppers with two straight sides and two sides at 70 degrees are fixed to the concrete entablatures and the material is discharged by means of twin tapered worms independently driven. Flour is conveyed to four elevators feeding redressing screens on the bottom floor of A mill, immediately above four high-speed packers weighing 5/6 140-lb. bags per min. The bags are held on power-operated revolving turrets on which there are mechanical "settlers" before the full bags are automatically released for stitching on *Sacsealers*. They then pass down spiral chutes either direct to vehicles or railway vans, or to pallets on the warehouse floors, where electric fork trucks stow the pallets (12 bags each in 4 tiers) three high, *i.e.* 12 bags high.

*(Concluded on page 66)*

# ACCELERATED FREEZE DRYING

*Interest in accelerated freeze-drying of solid foods has reached the stage where commercial operations on a large scale are imminent. While interested parties are avid for information, knowledgeable people are understandably cautious. An air of uncertainty therefore hangs about the whole subject—will it or will it not assume major proportions in food technology?*

*To assist in clarifying the position,* FOOD MANUFACTURE *commissioned two experts in the field to write the following articles. One was until recently at the Aberdeen Experimental Factory where the pioneering work was done and is now continuing his work in industry, and the other is directing the team working on the first commercial plant now being erected in the British Isles.*



## I—Developments to Date

**By J. McN. Dalgleish,* B.Sc., A.M.I.Mech.E.**

*Mr. Dalgleish knows the experimental work at Aberdeen as well as anybody, having been one of the people who carried it out. In this article he reviews the trend of the Aberdeen work and spotlights the fundamental achievements.*

WORK done at the Research Establishment of the Ministry of Agriculture, Fisheries and Food, in Aberdeen, Scotland (*to be closed on March 31, 1961*), has resulted in the development of an economic process for the freeze-drying of foods.[1, 2, 3] As a background to this development the Engineering Research Section devised and operated a unique experimental dryer which, by means of its unusual devices and instrumentation, has enabled the staff to investigate vacuum-drying, classical freeze-drying and the new accelerated freeze-drying techniques in a way not hitherto possible. It is known as E.V.E. (Experimental Vacuum-drying Equipment). (Fig. 1.)

### Danish process

The improved experimental methods alluded to include the measurements, by thermocouples, of temperature at various depths in the food and between food and tray, and tray and heating-shelf, etc.; the capability of moving heating-plates relative to the food; the weighing of trays without breaking vacuum, and therefore the derivation of direct drying curves; and an unusual control and measurement of vacuum, heat input, and plate pressure.

(*Above*): **Fig. 1. View of interior of E.V.E. pilot plant, fully instrumented for study of the physics of freeze-drying processes.** (*Crown copyright photo. by permission of Controller, H.M.S.O.*)

Historically, the Research Establishment investigated vacuum-drying in the form of the Danish "pressfisk process" in commercial-sized plant manufactured by A/S Atlas of Copenhagen and installed in the Establishment's Experimental Factory. This method of drying was known as V.C.D. (Vacuum Contact Dehydration) since it took place at a pressure of 10-25 mm., and heat was applied from both above and below by a system of heating plates arranged to close on the trays of food, and by means of a link-device and a hydraulic ram, to maintain a certain pressure throughout the drying and consequent shrinking of the food.

There is no doubt that this was an advance over air-drying, and the heating from both sides at once reduced drying times from

* Formerly of Engineering Section, Development Branch, M.A.F.F. Experimental Factory, Aberdeen, and now Head of Freeze Drying Department, Leybold-Elliott, Ltd.

those available in shelf vacuum-dryers; but the required quality, and notably degree and speed of rehydration, was not shown in the products.

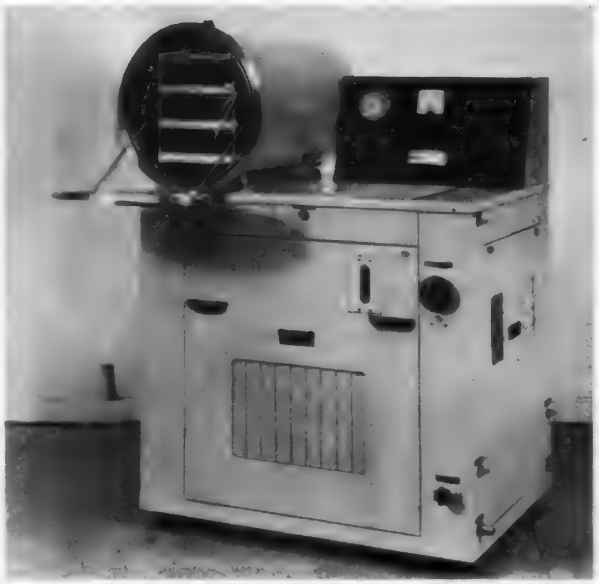
**Improving the vacuum**

At this stage a successful attempt was made to freeze-dry in the equipment by improving the vacuum. Modification of the steam ejector equipment[4] made it possible to attain and maintain in the cabinet, pressure in the region of 1·5 mm. Fish, which thawed completely at about −5°C., was used in these early tests and it was found just possible to dry reasonably thick fillets (10-20 mm.) at an internal ice-temperature of about −10°C., and in about 12 hours.

These conditions of vacuum and temperature were, of course, outside the range of ordinary, or "classical," freeze-drying, but the speed-up in the process was economically very significant. Nevertheless, the process was unreliable[1] and it was clear that the straightforward double contact heating developed for liquid-phase vacuum drying could not be employed effectively on a uniform slab of material frozen on to a drying tray because of the inherent suppression of vapour paths over the surface of the material to the free edge of the tray/food/lid "sandwich." This phenomenon was labelled "stifling," and it resulted in a local build-up of vapour pressure, and so temperature, with consequent thawing.

Around this time experiments were being conducted elsewhere (notably by Tappel[5] and others in the U.S.A.) on the application of classical freeze-drying to foods, but in some cases the slab material, *e.g.* beef-steak, was frozen to the plate—which aided heat transfer but forbade rapid heating for fear of melting. In most cases cabinets with one shelf, or shelves spaced widely apart, were used so that heating was essentially from one side only.

Most important, however, was the fact that the pattern of freeze-drying extremely heat-sensitive biological and pharmaceutical material was rather too closely followed. The equipment used was commonly of the standard design with a refrigerated condenser and backing pump, giving extremely low pressures in the drying chamber (with correspondingly enormous volumes, thereby limiting the economic pay load) and unnecessarily low temperatures. We of the Experimental Factory now thought it wrong to consider food-drying as a simple extension of classical pharmaceutical drying.



*A new type of tray dryer catering for the pilot plant field is this 30P1T freeze-drying plant made by Edwards High Vacuum, Ltd. It has been designed for smoothing out production difficulties before employing larger tray dryers such as the same firm's 51P and BP series of automatic plant. It comprises a stainless steel horizontal cylindrical drying chamber with three aluminium shelves in which are embedded stainless steel pipes for circulation of refrigerant when material is required to be frozen in situ. A refrigerated water vapour condenser served by a compressor is mounted in a stainless steel chamber with an aluminium lid. A separate refrigeration compressor mounted inside the cabinet provides the cooling for the shelves (−30°C.). The plant is completed by a "Speedivac" two-stage vacuum pump.*

**Limiting factors**

Smithies and others in Canada[6] realised that under these conditions the limiting factor was one of heat input, and went to the logical, but impractical, conclusion of impaling the food on spiked heating plates.

The Aberdeen equipment, being capable of adequate heat input, had brought the development to the stage of the next limiting factor, vapour egress.

Meantime, other work at Aberdeen had dealt with the rate and depth of freezing, the type of surface resulting from transverse or longitudinal cutting and sawing of muscle tissue, storage tests of dehydrated products at different moisture contents, and time-temperature tolerance of dry fish fibres.

**Prototype built**

The construction of E.V.E. permitted such knowledge to be applied to the development of a specification for an accelerated freeze-drying (A.F.D.) prototype cabinet. An accurate method of weighing the drying food at intervals, without interrupting the vacuum, gave weight-loss curves from which the mean rate of recession of the ice front (in slab forms, for example) could be predicted. A linkage-magnified spacing indicator in conjunction with a paired screwjack system for adjusting shelf aperture permitted repeatable studies of vapour-path restriction. The temperature of an artificial icicle installed within the cabinet served as a guide to the vapour pressure gradients involved. Thermocouples with ends adapted for particular duties by gauze or foil extensions were used to record more accurately the conditions at interfaces and surfaces.

It was now found possible to shelf-freeze-dry a 15 mm. thick

transverse-sectioned slab of pre-frozen codfish to approximately 2% moisture content in about eight hours. This was achieved by bringing the upper heating plate close to, but not touching, the upper surface of the material and by careful attention to the temperature of its lower surface, which was not frozen on to the under-shelf.

For this improved freeze-drying the shelf temperature was kept low (between 10°C. water mains temperature and room temperature) until the vacuum was fully established, and then raised to about 120°C. as fast as was consistent with not melting the surface of the fish; and it was inferred from a study of the residual ice in partly-dried samples that drying proceeded almost as rapidly from the lower as from the upper surfaces.

It would appear that vapour issuing from the under-side of the mass raised the material from the shelf and protected it from overheating until towards the end of the run. Then resistance to vapour flow within the almost dry material became such that the quantity of vapour issuing was insufficient to protect it in this way; and the temperature of the shelf had to be lowered as the dried under-surface came into more intimate contact with it.

(Heat damage to the dry tissue is a function of both time and temperature, but within the times concerned here we limited the maximum permissible temperature at the food/tray interface to 60°C.)

It is noteworthy that all the heat energy to be supplied to the circulating water system for the rapid-start, batch drying cycle is put in in the first 15 minutes. After that the process operates on the heat stored in the plates and circulating water, whose temperature cools from then on.

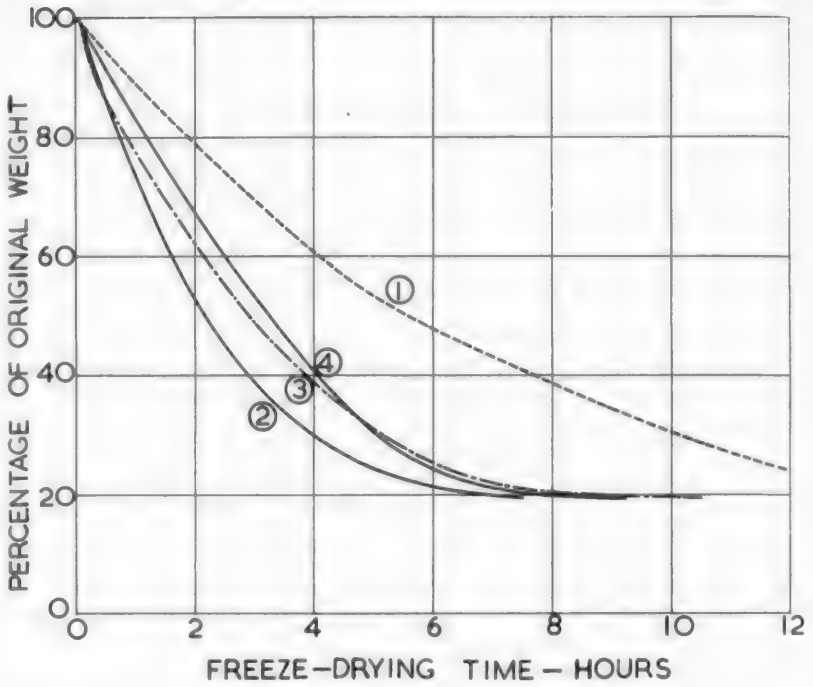



**Fig. 2. Comparison of weight-loss curves for 15 mm. thick cod steaks.**

1. **Traditional shelf freeze drying; process too cautious to be economical.**
2. **Double insert A.F.D. Insulating barrier reduced by heavy mechanical pressure. Advantages gained by expensive capital outlay.**
3. **Single insert A.F.D. Lower side external vapour path too large for later stages.**
4. **Streamlined shelf freeze drying; full advantage taken of simple plant.**

**All to below 1·5% moisture content.**

### Importance of free vapour path

The outstanding general principle derived from the work up to this stage was that for a given ice temperature (avoiding melting), a given dry-surface temperature (avoiding denaturation) and a given cabinet pressure (depending on the economics of the vacuum system) the rate of permissible heat input, and therefore the length of the operation, is limited by the necessity to establish and maintain a free vapour path between the food and the heating shelf.

A mechanical method of doing so is to place an expanded metal or other suitable insert between the material and the plate,[7] which device will lead (provided not less than 2% final moisture content is demanded) to the same overall drying time as is indicated above. The slope of the weight-loss curve, however, indicates that the expanded metal insert permits the shelf temperature to be raised higher and faster at the beginning of the process.

Towards the end of the process this mechanically-contrived vapour path is greater than in natural shelf-drying and the cooling effect of the out-flowing vapour is lost, so that in spite of the need at this point for improved heat transfer the temperature of the heating shelf has to be lowered. The heat input by conduction through the expanded metal in contact with perhaps only 30% of the total area is so reduced that the drying rate falls off and negates the initial advantage by a prolonged final stage.

If an expanded metal insert is placed above the food as well as below then there is a slight restriction in vapour flow at the beginning of a run which shows up in the weight-loss curve; but it is then possible during the run to apply mechanical pressure so that both inserts are driven a short distance (of the order of 1 mm.) into the material, not only penetrating into the dry layer and reducing its heat-insulating effect, but also spreading the tissues locally and thereby helping to maintain adequate vapour paths. This double insert system has a further advantage in that it is

possible to increase the heating plate temperature very rapidly indeed at the start of a run, taking full advantage of the cooling effect of the very copious flow of cold vapour.

The pattern of weight-loss curves for 15 mm. fish steaks processed in the various manners is typified in Fig. 2. Actual process times are, of course, particular to the loading.

Similar patterns can be shown for other commodities in appropriate forms of bed. It should be noted that pressure on leafy materials can cause stifling such as will retard drying; some safeguard against this type of difficulty can be achieved by putting an additional insert or inserts within each bed, *i.e.* by drying multi-deck fillings in the "sandwich." Obviously, preparation cost is increased.

**Difficulties of surface temperature measurement**

Under such (A.F.D.) conditions of extreme heat gradient (the heating water temperature may be 140°C. and the ice surface −20°C.) it is extremely difficult to measure the true surface temperature and the interface thermocouple readings observed at certain stages are believed to be significantly higher than the true temperature suffered by the tissues. It is in the measurement of true surface temperatures that the most rewarding achievement in instrumentation would now seem to lie.

Looking back on previous techniques in the light of present experience, then, it appears that the direct application of classical freeze-drying of food failed to offer a commercial solution because of inability to judge the maximum permissible rate of heat input consistent with not melting the frozen material.

The application of V.C.D. to freeze-drying failed because of the phenomenon of stifling, or inability to remove vapour at a rate commensurate with the heat input. A.F.D. with expanded metal offers a mechanical solution with limitations.

The overall limitation in any attempt to accelerate the freeze-drying of discrete pieces of foodstuffs in quantity is the twofold problem of conducting heat into the retreating ice surface and conveying vapour out from it through an increasing barrier of insulating, porous dry material. The traditional method gave a tedious final stage lasting hours. The A.F.D. solution as at present practised presents a rapid beginning lasting minutes, but the progressive slowing of this process is shown up in markedly skew heat input and vapour removal curves and has a devastating effect on the size and cost of equipment, which must be designed to cope with high maximum demands of very short duration, and for the greater part of the drying cycle needs be most wastefully employed.

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## Notes for Contributors

The Editor of FOOD MANUFACTURE welcomes articles, news items and other contributions on all aspects of food production.

The contribution should be typed in double spacing on one side of the paper only. It should bear the name and address of the author and should be accompanied by photographs suitable for illustrations.


## Data for Technologists

THIS ponderous volume* contains a great deal of useful information and is claimed in the foreword to be "unique in the food field." The compilers are employed by the Pillsbury Co., suppliers throughout the U.S.A. of flour and bakery mixes, and the book is biased towards milling and baking, but there is much information on other foods, and the book is in no sense a "trade publication."

It is divided into sections as follows: conversion factors, measurements and equivalents; wheat and mill products; foods and food ingredients; analytical and physical data on foods and food ingredients; general bakery data; plant and equipment; electrical engineering data; heating and ventilation; water; nutrition; temperatures; definitions and standards of identity; miscellaneous; glossaries and abbreviations.

The classification of material is not always very logical. Thus a table "Labour market indicators" is included in the "Plant and equipment" section, but information on sieve sizes is given in the "Miscellaneous" section. The 34-page index is good and goes some way to remedy this.

The same fault is apparent in the four glossaries, which should have been amalgamated. One does not expect to find definitions of apricot pulp, aroma, blackstrap and butterscotch (to take only a few examples) in a glossary of "Technical bakery terms," and of these only butterscotch is indexed.

There is a vast amount of useful information in this book, and it should be of considerable value to the British food industry, though the legal information is of course inapplicable in Britain. The text is typescript reproduced by lithography, but is clear and reasonably free from mistakes. It is to be hoped, however, that future editions will be better arranged.—D. J. CAMPBELL.

* *Conversion factors and technical data for the food industry.* Compiled by C. G. Harrel and R. J. Thelen, 6th ed., 1959. Burgess Publishing Co., Minneapolis 15, Minn., U.S.A. Pp. 1426. Price $20,00.

## *Accelerated Freeze Drying*

# II—Fundamental Design Problems

**By K. Ward,* B.Sc.**

*Mr. Ward is in charge of the work on the freeze-drying plant now being built for the Irish Sugar Corporation at Mallow, Ireland. He discusses various possible configurations of freeze-drying equipment from the technical aspect and delves into the vitally important subject of costs.*

FREEZE-DRYING has been in use for several years in the pharmaceutical industry, but until recently its application to food processing has received very little serious consideration. However, work carried out by the Ministry of Agriculture, Fisheries and Food at Aberdeen has shown that food processed in this way can be comparable with deep frozen food, not only in quality but also in cost to the consumer. When one considers that once a freeze-dried material has been packed it can be transported and stored without refrigeration or any other special precautions, it is hardly surprising that the Ministry results have been hailed as a major advance in food processing.

A considerable amount of publicity has been given to the quality and convenience of freeze-dried foods and it is not proposed to enlarge on this aspect here, except to explain some of the reasons for the high quality. The fundamental point to bear in mind when considering quality is that once a material has been frozen it is to all intents and purposes dry. If, therefore, the water can be removed from the frozen state without damaging the food, the quality will be the same as the frozen food.

In freeze-drying this requirement is fulfilled, the ice is converted directly to water vapour by processing at very low absolute pressures (sublimation) and the dry product never reaches the temperature at which heat damage occurs. It is by virtue of sublimation that the food structure is unchanged during drying as the escaping vapour does not produce shrinkage nor is it capable of carrying dissolved salts to the surface as in the case of liquid phase drying (*e.g.*, air drying).

* Food Project Engineer, Vickers-Armstrongs (South Marston), Ltd.

### Pre-processing and packaging requirements

As far as ancillary operations are concerned the requirements of freeze-drying are similar to canning or deep-freezing, the pre-processing being virtually identical. Packaging presents a somewhat different problem as the dried food must be protected from oxygen, water vapour and light, and some form of vacuum or gas pack is necessary. These requirements are, of course, easily met by canning, but it is felt that this would detract from the inherent convenience of freeze-dried food, *e.g.* pre-cooked complete meals. A more convenient container is one of the type currently used for vacuum packing where an impervious liner is placed inside a printed carton.

## DESIGN PROBLEMS

The design of equipment for the freeze-drying process presents interesting problems. The overall criterion for the machinery manufacturer is, of course, the production of the most economic unit in terms of the processing cost per pound consistent with the requirements of a truly freeze-dried material.

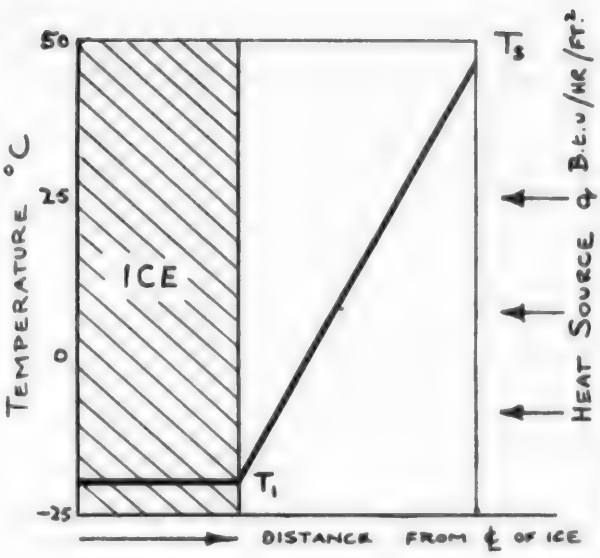
This is not simply a matter of keeping the capital cost to a minimum but involves considerable research into the whole process so as to ensure that the basic design is capable of producing the most economic results. For example it is of little value to simplify the equipment in some way so as to save, perhaps, 10% in the capital cost if, by so doing, the cost of processing is increased by 20%. To this end, careful consideration must be given to the methods of supplying the heat of sublimation to the ice and of maintaining the vacuum since it is in these fields that the major economies can be made.

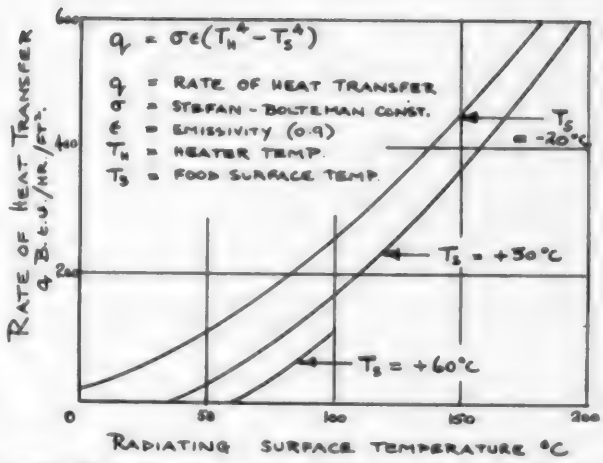
### Supply of heat for sublimation

The method of supplying the latent heat of sublimation can have major effects on the processing costs. This is not due to the cost of the heat itself—about 1,200 B.t.u./lb. of ice—but to the fact that the size of the drying unit is directly dependent on the drying time for a given throughput.

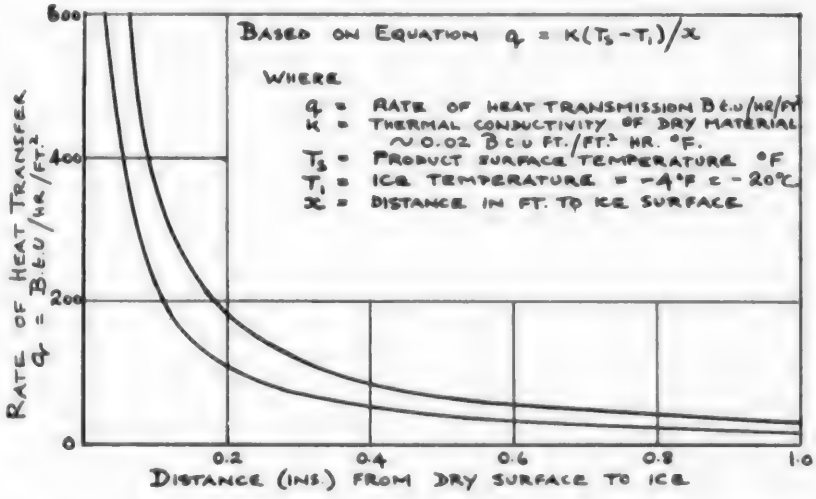
Before discussing the methods of supplying heat to the food let us consider the heat-transfer within a typical fibrous material. If dielectric heating is neglected (this is discussed below) the heat must be conducted through the dry fibre to the ice front (Fig. 1).

Fig. 2 shows the variation of rate of heat transfer with the distance between the surface and the ice layer based on the assumption that the rate of heat transfer is equal to the product of the thermal conductivity and the temperature




(*Left*): **Fig. 1. Temperature distribution through partially dried layer.** (*Below*): **Fig. 2. Variation of rate of heat transfer with distance from dry surface to ice layer (upper curve: $T_s$ = 60°C; lower curve: $T_s$ = 30°C).** (*Above*): **Fig. 3. Variation of rate of heat transfer with radiating temperature.**


BASED ON EQUATION $q = K(T_s - T_1)/x$
WHERE
q = RATE OF HEAT TRANSMISSION B.t.u/HR/FT.²
K = THERMAL CONDUCTIVITY OF DRY MATERIAL ~ 0·02 B.t.u FT./FT.² HR. °F.
$T_s$ = PRODUCT SURFACE TEMPERATURE °F
$T_1$ = ICE TEMPERATURE = -4°F ≈ -20°C
x = DISTANCE IN FT. TO ICE SURFACE
RATE OF HEAT TRANSFER q = B.t.u/HR/FT.²
600
400
200
0
0·2
0·4
0·6
0·8
1·0
DISTANCE (INS.) FROM DRY SURFACE TO ICE

gradient. Due to the cooling effect of the liberated vapour this equation is not strictly true, but error introduced is, in fact, negligible.

From Fig. 2 it can be seen that as the product thickness increases the rate at which heat is transferred becomes progressively less and it is unlikely that thicknesses in excess of about $\frac{3}{4}$ in. can be made economic. Leaf materials exhibit a different type of heat transfer and the thickness limitation is not necessarily true in these cases.

In order to increase the rate of heat transfer the only variable is the temperature gradient, and since the maximum temperature is controlled by considerations of heat damage, this is dependent on the ice temperature. In order to reduce the ice tmperature the absolute pressure in the vessel must be kept as low as possible, but as the cost of maintaining vacuum is high it is uneconomic to produce ice temperatures lower than −20 to −30°C.

### Dielectric heating

From the foregoing remarks it will be apparent that if the supply of heat to the ice is by conduction through the dry layer, then without recourse to spikes, etc., the rate of drying is limited by the conduction, and provided that heat can be supplied to the product surface and the vapour removed at the requisite rate, the drying time cannot be shortened.

The only method of heating the ice without relying on conduction through the dry layer is by means of dielectric heating and at first sight this may appear to be the logical answer. However, at the level of vacuum required for freeze-drying (0·3 to 1·0 mm. Hg.) normal high frequency dielectric heating breaks down due to coronal discharge.

In an effort to overcome this problem the use of ultra high frequencies (of the order of 2,000 megacycles/sec.) has been investigated but in this case serious instabilities enter the system and it is therefore unlikely that a reliable freeze-drying unit based on this system could be produced in the near future. For the present at least it is therefore essential to consider other methods of supplying the heat.

In this case the possible methods of transferring heat from the heating system to the food are:

(*a*) gas conduction and convection;
(*b*) radiation;
(*c*) direct contact.

Of these, conduction and convection within the gas can be rejected immediately since the low pressure within the cabinet will rule out effective convection and the thermal conductivity is so low that very little heat could be transmitted. Although it is pro-

**Table I. Cost Breakdown for Steam Ejector Vacuum System and Steam Heated Plattens**

| Item | Amortization period (yrs.) | Total cost (£) | Annual cost (£) | |
|---|---|---|---|---|
| **1. Capital** | | | | |
| Freeze-drying plant, including installation | 10 | 250,000 | 25,000 | |
| Building and land (10,000 ft.²) | 20 | 50,000 | 2,500 | |
| Boiler and chimney | 20 | 15,000 | 750 | |
| Cooling tower | 20 | 5,000 | 250 | |
| Total capital: | | 320,000 | 28,500 | |
| Interest at 6% on Declining Balance (averaged over first 10 yrs.) | | | 10,650 | |
| Total capital and interest | | | | 39,150 |
| **2. Maintenance** | | | | |
| Assumed 2½% p.a. of initial capital outlay | | | | 8,000 |
| **3. Plant labour and overheads** | | | | |
| Plant operators 2-man shift 24 hrs./day 7 days/week—42 hrs./week/man = 8 men at, say, £900 p.a. | | | 7,200 | |
| Rates | | | 2,000 | |
| Insurance (1% of capital) | | | 3,200 | |
| Miscellaneous overheads—share of canteen, surgery, sports, etc. | | | 3,000 | |
| Total plant, labour and overheads | | | | 15,400 |
| Total annual costs (excluding plant basic running costs) | | | | 62,550 |
| **4. Hourly running costs** | | | | |
| Annual costs assuming 6,500 production hrs./yr. | | | £9·63/hr. | |
| Steam costs at 10/- per 1,000 lb. 1,600 lb./hr. of vapour removed requiring 8½ lb. steam per lb. of vapour for vacuum, plus 1½ lb. steam per lb. of vapour for heating | | | £8·00/hr. | |
| Electricity costs—240 kW at 1½d. | | | £1·50/hr. | |
| Water costs—2% make-up on 200,000 g.p.h. at 3/-/1,000 gals. | | | £0·60/hr. | |
| Total running costs from all sources | | | £19·73/hr. | |
| Raw material processed per hour | | | 1,866 lb. | |

**Cost per wet pound = 2·54 pence** total which is made up of:

| | |
|---|---|
| capital and interest | 0·78d. |
| labour, maintenance and overheads | 0·46d. |
| vacuum and heating | 1·30d. |

posed to neglect this means of heat transfer it will, of course, exist but will in general be only a minor source of heating. As far as radiation and conduction are concerned, both are possible means of heating and will be considered below.

**Heat transfer by radiation**

Classical radiation theory states that the energy radiated is proportional to the fourth power of the radiating temperature. Fig. 3 shows the theoretical rate of heat transfer appropriate to a freeze-drying system. Comparison of this figure with Fig. 2 shows that, except for the very early stages of drying it is theoretically possible to transfer sufficient heat by radiation.

During the early stages the limiting value of $T_s$ is not achieved in practice due to various limiting factors, and radiation can, in fact, supply the maximum usable heat from the outset. The problem which does arise, however, is that due to the non-homogeneous nature of the product the drying does not proceed evenly and when the maximum food surface temperature is reached the temperature of the emitting surfaces must be reduced in order to avoid local overheating, thus reducing the efficiency of the system.

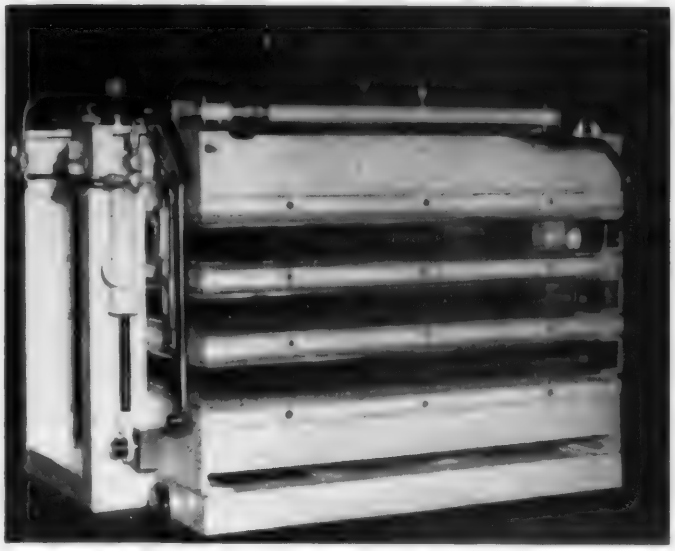
**Heat transfer by contact**

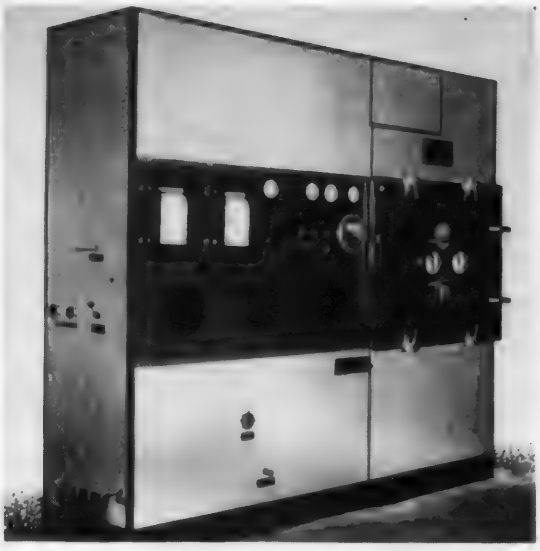
If intimate contact can be made between the heater and the food no problem exists in supplying the maximum usable heat at all times except at the end of the cycle, when, as in radiant heating, the temperature of the heater must be reduced so as to avoid heat damage. In this case, however, the restriction is less serious since the conductive heat transfer does not rely on the fourth power of temperature.

Two practical considerations prevent the achievement of intimate contact, however; the necessity of providing a free path for the escaping vapour and the difficulty of maintaining complete "flatness" over a tray of food both make it difficult to achieve the required goal.

It is in this field that the Ministry research has produced a major advance by the discovery that by sandwiching the food between layers of expanded metal and subjecting it to mechanical pressure, a highly satisfactory compromise can be achieved. The expanded metal not only ensures that vapour can escape freely but also, since it is pressed slightly into the food, it acts both as very short spikes and as a means of ensuring that contact is made with slightly thinner material on the tray.

Fig. 4 shows a photograph of a contact heater assembly which illustrates how the mechanical pressure is applied evenly to each shelf, the movement of the bottom heater being transmitted to the intermediate levels by means of the linkage shown on the left. The assembly shown forms part of a





(*Left*): **Fig. 4. Heating assembly of a special pilot accelerated freeze drying cabinet made by Vickers-Armstrongs.** (*Right*): **Fig. 5. Self-contained pilot accelerated freeze drying cabinet.**

self-contained pilot plant holding about 35 lb. of wet food (Fig. 5).

**Vacuum systems**

The pumping problem resolves itself into two problems, one of removing the air from the system and the other of removing the water vapour. The magnitude of the latter problem can be appreciated when it is realised that quite a small production unit processing about 20 tons of wet material a day will liberate water vapour at an average rate of about 1,600 lb./hour which, at a vapour pressure of 0·5 mm., represents a pumping requirement of about 1,000,000 cubic ft./min.

Clearly, mechanical pumping alone cannot be considered and a system involving the condensation of the water vapour must be used in conjunction with mechanical pumps, or alternatively, an ejector system employed.

In the case of ejector pumping there is no particular problem, from the design aspect, but such a system is fairly expensive to run, requiring about 8 or 9 lb. of steam for each pound of vapour removed, together with large quantities of cooling water. In spite of this, the ejector is in many cases extremely attractive due to its exceptional reliability. An additional feature which is of major importance in commercial application is the ability of the ejector to deal with large air leakage rates which may develop in the vacuum system due to accidental damage to seals, etc.

The application of mechanical pumps and condensers presents an engineering problem because, at the condenser pressures required, a refrigeration system working at an evaporator temperature of about −40°C. is required and the water vapour condenses as ice. If the process is to be continuous, multiple condensers are essential in order to permit intermittent defrosting. Offsetting this complication is the fact that cost of pumping by this method requires only about 300 to 500 watts per pound of vapour, and may therefore cost considerably less than ejectors to run. The present indications are that the capital cost of a refrigerated condenser system is considerably greater than that of ejectors.

In general the relative economies of the two systems must be studied for each particular installation when such things as availability of water, steam and cost of power supply are known.

## COSTS

Numerous claims regarding the overall cost of freeze-drying have been made and it is always difficult to analyse the source of differences. Table I shows a typical cost breakdown for a hypothetical semi - continuous freeze - drying plant capable of a throughput of 20 tons/day (1,866 lb./hr.) and examines the break-down of a particular costing process.

(N.B. This costing does not include any costs other than those associated with the drying process itself.)

In considering the figures in the table, it must be emphasised that the basic plant examined is hypothetical only and hence the figure of £250,000 for the installation cannot be regarded as reliable; however, from knowledge of present costs it is very unlikely that this figure is in error by more than 25%. This could increase the "capital and interest" by about 0·15d. The "labour, maintenance and overheads" figure is probably realistic and in any case is relatively small.

The vacuum and heating figure is based on known data for plant operating at 1 mm. Hg. and can be regarded as realistic. If a reduction in the operating vacuum is found desirable or, alternatively, the cooling water temperature is increased from the value of 65°F. assumed in the above figures it is possible that an increase of the order of 25% on the vacuum and heat figure could result, *i.e.* an

(*Concluded on page 66*)

# Pressure Packing . . .

*Does pressure packing offer solid advantages for the food processor? Experience in the U.S.A. suggests that it does. Technical developments in recent years, which include a promising new propellent, foreshadow great advances in the pressure dispensing of certain foods where time saving and greater convenience offset the increased cost.*

PRESSURE-packaged foods are at the outset of a major market growth. In the U.S.A. 1960 sales have been estimated at 75-80 million units, while the 1963 market has been forecast from a pessimistic 100 million aerosol cans to as much as twice this amount.

**New U.S. packs**

The reason for this favourable outlook is the wave of diversification which is now under way, thanks largely to significant technical developments of the last three years. Still the most successful food dispensed from pressure cans is whipped cream, which has enjoyed a steady growth rate since its introduction in the late 1940's. Effective new entries into the field date back only a few years. In 1956, a pressurised soft drink syrup was introduced with moderate success. In 1957, an aerosol barbecue sauce (Heublein) and pressure-packed chocolate syrups (Sifers) first appeared.

Nineteen fifty-eight saw the introduction of *Tasti Cup Instant*, a pressurised coffee package which has met with considerable success, while several new kinds of sweet toppings as well as salad dressings, orange drink, and meat tenderisers made their first appearance in pressure-packaged form during 1959.

Now on the horizon is an almost unlimited range of pressure-packed food products. Expected soon on the market in this form are fruit syrups, pancake batter, cake toppings, additional soft drink syrups and edible oils. Not much further down the road, but still awaiting the perfecting of methods for dispensing highly viscous liquids, are mayonnaise, soft ice creams, cake icings, and perhaps even peanut butter.

From the marketing point of view, the obvious attraction of pressure-packaged food is the convenience factor. Commercial success over the long run (*i.e.* beyond the initial "gimmick" phase) can be achieved only with foods where pressure packaging reduces time and irritation in home dispensing sufficiently to justify the higher price of this type of package.

To assess the marketability of the pressure-packaged product, the manufacturer must evaluate not only the factors which apply to essentially all types of package (product flavour and colour, price, sales appeal of container, etc.), but must also consider certain aspects specific to the pressure-packaged formulation. These include convenience of use, ease of operation, absence of product spillage or drip, safety aspects (tamper proof seal, approved propellent, adequate can strength) and factors of marketing convenience (stacking ease, package labelling, etc.).

**Production considerations**

On the production side, the food processor is faced with a number of questions specific to pressure packaging which include: choice of propellent, container requirements, method of sterilising packages of this type, valve selection, choice of activator, and method of packaging (including the question of captive *v.* contact filling). All of these factors must be weighed in specific relation to the product formulation and to the form in which the product is to appear when it is dispensed.

Because pressure packaging is still quite limited in the food field, processors are seldom technically equipped to undertake the design of this type of food package by themselves. However, assistance is readily available from outside sources, among them manufacturers of pressure cans and of aerosol valves, custom packagers, propellent manufacturers and consultants. Generally, the package is developed by co-operative effort of various members of this group.

**Recent developments**

The great growth potential in this field has been responsible for considerable technical advance in pressurised dispensers for foods during the late 1950's. Several outstanding developments may here be singled out:

***1. Propellents***

Until recently, only gaseous propellents (nitrogen, nitrous oxide, carbon dioxide) have been suitable for pressure packaging of foods, as conventional fluorocarbons, which serve as liquid propellents in other applications, have an objectionable taste and may, on occasion, even be converted to toxic fluorides. Here, an important development may be the introduction of *Freon-C318*, a propellent which is reported to be tasteless, odourless, and chemically stable, which is now awaiting approval by the U.S. Food and Drug Administration.

***2. Cans***

Introduction of pressure cans with soldered side seams is reported to permit production of pressurised food formulations with longer shelf life. Pressure containers of aluminium are now being made available and are finding acceptance because of their strength, light weight, ease of fabrication, and attractive appear-

# Boon or Gimmick?

**By Peter W. Sherwood**

ance. Of particular importance is the outstanding corrosion resistance of aluminium. Also, to cope with corrosion by foodstuffs, both plastic and enamel liners are being made available in conjunction with steel cans. Use of plastic-topped aerosol cans is growing.

### *3. Canning Operations*

These have become more completely automated and increased in speed. *Food Engineering* (Jan., 1960) reported that speeds on aerosol lines have been increased to 120 c.p.m. in non-refrigerated operation by the development of a new principle of 12-head rotary machines. This compares with the best reported speeds of 140 c.p.m. available for conventionally faster cold-fill lines (which employ liquid propellent).

#### Technical problems

Despite these general advances, several technical problems must be faced specifically whenever pressure packaging is to be adapted to a new food formulation. In broad outline, they fall into three areas: physical modification of the food to permit pressure packaging, biological preservation of the food in pressure packages, and cost of pressure packaging.

Some of the problems in the formulation's physical modification have been discussed by Riestor and co-workers (*Food Technology*, July, 1958). They find that propellent nitrogen, despite its slight solubility, may have an objectionable effect on the appearance of the dispensed product. In oils the effect may be considerable frothing, while viscous products (chocolate syrups, catsup, etc.) may have a frothy appearance when dispensed. In light syrups, a milky appearance is observed due to evolution of small gas bubbles when the food is dispensed, but here the problem is minimal because the bubbles are readily dispersed on short exposure to air. The extent to which objectionable froth is observed depends on the method of gassing.

Where the problem does occur, it can be minimised by static gassing, while pressurisation with agitation aggravates the difficulty—in the case of catsup, gassing with agitation actually caused an objectionable orange colour in the product, which was not observed under static gassing conditions.

Viscous foods pose a second problem in that too much of the product may be retained in the can after the package is exhausted. There are several ways of dealing with this problem. One approach —which is not always possible, however—is to reformulate to a lower viscosity. Aid is also given by treating the container walls with a slip compound. In any event, critical importance attaches to the location of the dip tube through which the food is dispensed. This should be run to the lowest point of the can when it is tilted forward, and it should face in the same direction as the dispensing valve's actuator spout.

#### Need for sterilisation

Pressure-packaged foods are subject to bacterial spoilage and sterilisation must be provided. The same rules of sterilisation apply as in regular packing. Foods of high acid and high sugar content may be held sterile by heat packing and heat gassing. On the other hand, low-acid foods, which must be processed above 240°F., are not amenable to hot-packing methods since pressure at the required sterilisation temperature exceeds the bursting strength of the can. In such instances, the pressure packager has to resort to aseptic packing conditions which are costly to maintain, at best.

**This Metal Box aerosol pack containing "Dry Fry" is the first aerosol food product to be made in this country.**

This is also an area where early potential is seen for the use of atomic radiation to effect sterilisation in the package. The slightly higher operating costs of this procedure can be justified in terms of the premium obtainable in this specialty use.

Examples of products where heat sterilisation followed by hot gassing is applicable are barbecue sauce, sugar syrups and salad oils. Such products must not be pressured with soluble gases such as carbon dioxide and nitrous oxide, however, since the equilibrium pressure with such gases is excessive (175 p.s.i.g. at 200°F. to maintain a pressure of 90 p.s.i.g. at 70°F.). In such instances, nitrogen is the preferred propellent, and argon may also be used but is significantly more expensive. With this gas, charging pressures exceed those desired at use temperature (70°F.) by only 30-40 p.s.i.

Examples of products not suitable for hot gassing are meat

spreads, whipped cream, and vegetable purées. Several processes (*e.g.* Avoset and Smith-Ball processes) are available for the aseptic packing of these formulations. In essence they involve heat sterilisation of the product and propellent gas, followed by cooling and packaging in pre-sterilised containers under aseptic conditions.

The anticipated introduction of liquid propellents for food packaging purposes (*Freon C-318*, referred to above) is expected to alleviate many of the difficulties connected with sterilisation of pressure-packaged foods at this time.

**What are the costs?**

The final chief problem in pressure packaging of foods is of economic character. The pressure packaging calls for significant capital investment and employs a somewhat more costly container (including valve and actuator) than are called for by standard packages. Relative costs must be determined individually, but, as a rule of thumb, in U.S. practice costs of pressure packages exceed those of standard containers by 5d.-10d. per (12 fl. oz.) unit.

This differential, however, covers manufacturing costs only and to it must be added the payout for the installation or, in the case of custom-packaged products, the contractor's profits.

The food marketer must balance these added costs against the premium (or profit from additional sales), which he can recover by virtue of providing the convenience of pressure packages to the customer.

# Accelerated Freeze Drying: II—Fundamental Design Problems

(*Concluded from page 63*)

increase of 0·33d./lb. Taking all adverse figures into account, this could result in a total cost per wet pound of the order of 3d.

In addition to the above costs it may be necessary to pre-freeze some materials—particularly meat and fish—but the cost of this operation is well within the order of accuracy of the overall figure.

If the ejectors in the above system are replaced by refrigerated condensers and pumps the capital cost may be increased by about £30,000 (0·08d./lb.) and the vacuum and heating cost would be modified to:

| | |
|---|---|
| power—0.5 kW/lb. of vapour per hour—800 kW @ 1½ ... ... | £5/hour |
| steam (heating)—2,400 lb./hr. @ 10/- per 1,000 lb. ... ... | £1.2 ,, |
| water—negligible ... ... | — |
| total cost of vacuum and heating | £6.2/hour |
| Cost of vacuum and heating per wet pound ... ... | 0.8d. |
| *giving* | |
| **total cost per wet pound ...** | **2.12d.** |
| which is made up of: | |
| capital and interest ... ... | 0.86d. |
| labour, maintenance and overheads... ... ... ... | 0.46d. |
| vacuum and heating ... ... | 0.80d. |

The above figure is subject to less variation than that for ejectors as the design vapour pressure is much lower and it is less sensitive to cooling water conditions. By virtue of the added complexity of the system the allowance for labour and maintenance should possibly be increased, and a reasonable maximum cost per wet pound could then be of the order of 2·5d.

In examining the above figures it must be realised that in a semi-continuous freeze-drying operation the rate of vapour removal is independent of drying time for a constant throughput and hence only the "capital and interest" figures are directly dependent on drying time (since the physical size of plant is dependent on this parameter). For this reason it is believed that the figures given above can be regarded as reasonably realistic.

For a small batch cabinet system the cost/lb. would be greater than above due to inefficiencies in the vacuum system when dealing with fluctuating loads, and the cost may well be double the above figures for small throughput.

It must be emphasised that the costings outlined above take no account of the substantial economies inherent in the storage and transportation of freeze-dried products. The possibly higher processing costs of freeze-dried foods compared with deep frozen food must be offset against savings in a lower rate of spoilage and extended storage without refrigeration. In addition, transportation costs will be lowered owing to reduction in weight and the elimination of refrigeration vehicles. Thanks to these savings, freeze dried foodstuffs may well retail profitably in Britain at prices competitive with deep frozen food. Moreover, they can be kept on the larder shelf for many weeks after purchase and can be economically machine vended.

In the above paragraphs an effort has been made to review objectively some of the fundamental problems associated with the freeze-drying of food. From the engineering standpoint it would appear that no serious barrier exists to the achieving of the processing costs discussed and it is believed that, at this level, freeze-drying has much to offer both the processor and the consumer.

## Spillers' Millennium Mills

(*Concluded from page 55*)

*Sealtite* automatic weighing and packing machines are used for small packets of self-raising and white flour.

**Some Suppliers of Equipment**

W. and T. Avery, Ltd.: automatic weighers.
Buhler Bros.: pneumatic system.
Ivers-Lee (Gt. Britain), Ltd.: *Sealtite* packing machines.
Mather and Platt, Ltd.: sprinkler system.
Medway Paper Sacks, Ltd.: *Sacsealer* stitching machines, high-speed packers.
Redler Conveyors, Ltd.: conveyors.
Thomas Robinson and Son, Ltd.: plansifters, bran-dusters, spout dampers.
Henry Simon, Ltd.: pneumatic intake plant, dryers, *Exact* measurers, conditioners, rollermills, *Seniorsifters*, purifiers, bran finishers.
Richard Simon and Sons, Ltd.: weighers.
E. R. and F. Turner, Ltd.: *Minorsifters*.

★ *Progress in 1960* ★

# BREWING REVIEW—I

By J. Hoggan,* Ph.D., B.Sc.

*Recent advances in malting techniques, new knowledge of bittering and flavouring constituents, effect of metal contamination, haze formation, yeast growth, keeping quality, and a new process for lager production are discussed in this special review.*

IN a previous review the trend towards continuous processes was discussed quite fully; in this review, therefore, it has been decided to concentrate upon newer developments in problems of fundamental importance.

## BARLEY AND MALT

Barleys of the 1960 season have a similar total nitrogen content to those of the previous year, but it has been found that dormancy is not so extensive as before. In practice, it has been found that the 1960 season's barleys have a high germinative energy. However, the striking contrast in weather conditions of the 1959 and 1960 seasons must have resulted in barleys of different characters.

Recently,[1] it has been said that over the extreme ranges of nitrogen content encountered, certain varieties of barley such as Proctor yielded hot-water extracts which varied inversely with the nitrogen content of the barley, whereas other varieties such as Domen yielded high hot-water extracts even when their nitrogen contents were high. With reference to Proctor barley, it would appear that this is an over-simplification of the situation as it is. Diastatic power also has an influence upon this relationship, and it has also been found in practice that the relationship for Proctor as mentioned above only holds over a certain range of total nitrogen values.

Two compounds are now in use in commercial malting—namely, gibberellic acid and potassium bromate. The acid can either be applied to the steep liquor or sprayed over the grain when on the floor, whereas bromate is applied to steep water in most instances. These two compounds differ in their actions in regulating malting growth, the gibberellic acid enhancing all metabolic processes giving improved malt modification.

### Gibberellic acid and pot. bromate

Treatment of barley with gibberellic acid has been found to overcome dormancy and to stimulate the secretion of enzymes from the embryo and thus to increase the rate of modification of the endosperm as measured by hot-water and cold-water extracts and the concentration of soluble nitrogenous compounds. The increased amount of soluble nitrogenous compounds of low molecular weight points to an increased peptidase activity whilst the wort also contains more high-molecular weight material. These facts seem to indicate that the increased activity of proteolytic enzyme systems has resulted in a greater degradation of the "protein shell" which has been said to inhibit the extraction of carbohydrates during mashing.[2]

The recommended optimum concentration of gibberellic acid in the steep water is 0·5 p.p.m., which compares very favourably

**Malt in a kiln being turned mechanically.**

* Chief Chemist, Truman, Hanbury, Buxton and Co., Ltd. (Burton-on-Trent).

with the previous figure of 2 p.p.m. There are also indications that this figure of 0·5 p.p.m. can be further reduced if it is decided to sprinkle the solution over the grain on the floor. However, the optimum concentration would have to be determined for different barleys and barleys of different seasons because it is certain to vary within narrow limits. A common objection to the commercial application of this compound is the seemingly high price, but applied at the rate of 0·5 p.p.m. and considering the benefits to be obtained in the way of an increased extract, shorter malting period, and a decreased malting loss, objections on the grounds that its successful exploitation depends on the price are completely unfounded.

**Modified treatment reduces P.S.N.**

It has recently been suggested[3] that potassium bromate should be used in conjunction with gibberellic acid. It is said that bromate has one disadvantage, for some purposes, in that it tends to increase the permanently soluble nitrogen (P.S.N.) in the finished malt. The effect of bromate in the early stages of malting is to restrict proteolytic activity and P.S.N. develops more slowly than in controls, though it eventually reaches a higher value.

On consideration, it seemed that it might be possible to produce a malt with a lower P.S.N. by sprinkling bromate on the grain in the middle of the germination period. The effect of this after 48 hours was compared with the results from a control piece (sprinkled with water), and after a six-day flooring period the treated barley had a slightly higher extract, lower P.S.N. (0·450% against 0·475%) and lower malting loss (6·2% against 7·5%).

From these results the author thought it expedient to employ bromate with gibberellic acid to prevent the large increase in P.S.N. brought about by the latter. The optimum concentration recommended is 0·3 p.p.m. gibberellic (of grain) sprinkled on the grain when cast from the steeping tank, followed by bromate at up to 450 p.p.m. of grain 12 hours later. When compared with gibberellic acid treatment alone the modified procedure resulted in an extract enhanced by about 1 lb., the P.S.N. was reduced from 0·6% to 0·5% and possibly lower and the malting loss was reduced by about 2%.

It may be of interest to record that the Proctor barley employed in these trials had a total nitrogen content of 1·5%.

The use of gibberellic acid in malting has been approved by the Ministry of Agriculture Advisory Committee and also by the U.S. Food and Drug Administration. In either instance the maximum quantity allowable in malting is 2 p.p.m. of the grain.

## HOPS

Gibberellic acid which has been discussed in relation to malting of barley has also been applied in the form of its potassium salt to hops.[4] The hops were sprayed with a solution of the salt (12 p.p.m.) and they exhibited a great surge of development and reached maturity as well as a greater weight about 10 days earlier than the controls. However, it was found that the α-resins content of the cones of the plants was reduced drastically to 1·8% in the treated hops as against 10·2% in the controls. The total soft resins content was 9·7% against 21·8% in the cones from untreated plants. Thus, one of the most important group of substances in the hops from the brewers' point of view was found to be greatly reduced by this treatment.

**Recently discovered bittering principles**

The problem of what constitutes bitterness in beers has been discussed recently by Meilgaard.[5] This, naturally, involves a further problem, that of deciding which is the best analytical method to employ as a means of obtaining a measure of bitterness.

Firstly, it is a simplification to treat hops as if the three α-acids (humulone, cohumulone, adhumulone) were the only potential bittering substances in hops. Only recently,[6] three substances, named hulupones, which have a strong bitter taste were discovered. These substances seemed to be present in all types of hops in amounts up to 3%. The bulk of these substances is left in the spent hops after wort boiling, but it is certain that a considerable fraction is transferred to the wort in unchanged form. There are several other bitter principles and some of them are utilised as well as, or better than, the α-acids.

**Lab analysis of bitterness**

For fresh hops probably 85% of the bitterness is due to the α-acids and the error involved in neglecting the remaining substances is less than the residual 15% because bitterness due to these substances does to some extent follow that of the α-acid group. As the hops age the α-acids deteriorate, and other substances are formed from them which, while bitter, do not appear in the analysis. Generally, it has been found that hops lose 10-50% of analysable α-acids per annum in cold storage. In contrast to this, the bittering power drops less than 10%; a 3-year-old hop may have lost 70% of its analysable α-acids while still retaining over 80% of its original bittering power.

It follows that the original content of α-acids, whenever the figure can be obtained, is a much better measure of the bittering power than is the present content of α-acids. It is then much more accurate to deduct 7-10% for each year in cold storage than it is to make renewed analyses.

Meilgaard[5] has repeatedly found that the conductimetric lead acetate titration of chloroform extracts of hops falls off at the same rate as the bittering value (7-10%) in contrast to other methods of hop analysis. Thus, regardless of the state of preservation of the samples this method gives results more related to the original bittering values. There is no doubt that for older hops this method gives a better measure of the bittering

value than does the content of analysable α-acids.

The conductimetric method is ideal for routine use in a small or medium size laboratory because the method is accurate and quick and the various instruments available are inexpensive. The method can also be applied to the measurement of isohumulones in beers, a recent method developed[7] using nickel acetate as titrant. The nickel combines stoichiometrically with isohumulones thus allowing their estimation. However, the real value of this method lies in obtaining comparative results of a range of beers within a brewery, and it should not be employed to compare the isohumulone contents of beers manufactured under different conditions. This can be taken further by saying that, despite our scant knowledge of what constitutes bitterness, provided one method only is employed to measure "bitterness" one can obtain useful information.

The content of isohumulones is not the only factor that determines the bitterness of beer, but the fact remains that the chemical procedure when employed in conjunction with tasting tests should enable the brewer to maintain a constant intensity and quality of bitterness.

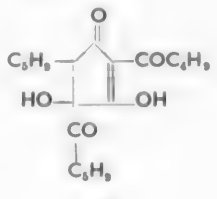
**Factors affecting bitterness**

It is reasonable to assume that 85% of the bitterness in normal beers is due to isohumulones, and that the errors involved in partly neglecting the remaining bittering substances are probably small. However, it is a fact of observation that even beers which do not contain much else than isohumulones may vary considerably in the intensity and quality of their bitterness at a given level of isohumulones. The bitterness of these compounds can be masked, or enhanced, or be given a coarse or lingering quality by the influence of other substances in the beer.

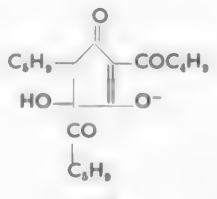
*p*H is certainly an important factor because these isohumulones are weak acids and can exist in two forms, the undissociated molecule (I) which is much less

**Hop samples are subjected to "hand evaluation" by brewers.**

soluble in water than (II) the dissociated variety.



(I)



(II)

At *p*H 5·2 (as in wort) there is 50% of each form present, whereas in beer at *p*H 4·2 there is 10% dissociated (II) and 90% of undissociated forms (I). This information is utilised in the extraction of isohumulones for estimation when beer is rendered highly acid in order to convert the isohumulones to the undissociated form which is easily extractable in non-polar organic solvents. It is well known that wort has a strong and coarse bitterness and that beers of high *p*H (low acidity) have a more unpleasant bitterness than beers of low *p*H values.

Meilgaard[5] suggests that the dissociated molecule (II), with its higher water solubility and more inorganic character can more readily penetrate into the taste buds and irritate the nerve ends, whereas the undissociated molecule (I) with its more organic character and lower solubility will tend to be adsorbed on the beer colloids and exert less influence on the taste buds.

## FLAVOUR

It is known that the volatile constituents of beer are of considerable importance in characterising flavour and aroma, and the recent application[8, 9, 10] of analytical methods to determine these constituents is of great interest.

Gas chromatographic analysis now permits the separate determination of the different constituents of a volatile mixture, and so the limitations of tasting in detecting defects can be eliminated.

Normally, beers contain on an average 60 p.p.m. of esters and 40 p.p.m. of higher alcohols, there being on average five esters and five alcohols in beer which can be determined quantitatively by this procedure. These constituents are ethyl, propyl, butyl and amyl acetates and isobutyl, normal butyl, isoamyl and normal amyl alcohols, while acetaldehyde and acetone are also present in relatively large amounts.

Thus, the contribution of malt to beer flavour must not be underestimated, and it seems quite reasonable to assume that varying degrees of malt modification will result in beers of different flavours. The sugars of malt predetermine the volume of ethyl alcohol formed, altering at the same time the flavour composition by introducing concomitant fermentation products such as the esters, higher alcohols and acetaldehyde already mentioned. The ethanol acts as a solvent and carrier of flavour, producing an effect dependent on the amount of alcohol-soluble flavouring constituents present.

**Stability of flavour constituents**

It had been found, in fact, that acetone remains at a fairly constant level while other constituents vary quite considerably during the processing of different worts. During fermentation, each component appears at a definite stage of fermentation, and increases to its maximum at a definite and characteristic rate, according to the particular brewing conditions employed. The levels of esters and amyl alcohols increased significantly from the last day of fermentation to the first day in tank. Higher alcohols increased significantly during the first 14 days in store, and over a period of five months in bottle the esters and amyl alcohols steadily declined whereas acetone remained constant. It has been suggested that the stability of these components may be related to a "taste stability pattern."

In considering flavour it is important to remember that other components such as the residual non-fermentable carbohydrates, nitrogenous constituents (flavour intensity increases as they approach the amino acid level), melanoidins, tannins and inorganic salts such as potassium phosphate all make important, though not always favourable, contributions to beer flavour.

## METALS

In brewing, metal contamination has important, but often deleterious, effects on beer properties as well as influencing yeast condition. A recent investigation[11] discusses the effect of metal ions on beer properties, particularly foam. The results recorded refer specifically to the behaviour of nickel in the presence of isohumulones.

The concentration of nickel ions is shown to be directly related to foam stability (head retention) of beer, this effect being increasingly enhanced by an increasing content of bittering substances or isohumulones. In other words, the greater the hopping rate of a beer, the greater is the effect of nickel on foam stability. The foam, besides becoming more stable, also contained more isohumulones the higher the nickel concentration of the beer, and, furthermore, it is stated that nickel only affects foam properties in the presence of isohumulones. The nature of the interaction between isohumulone and nickel is thought to be a chelate or complex formation. Such complexes were also formed between other metals and isohumulones, and from the results obtained it was obvious that metals which may easily pass into another state of oxidation, *e.g.* copper and iron, showed deviating properties.

**Effect on bitterness**

The interaction of metal ions with isohumulones in beer is, therefore, not the same for all metals. In fact, there are two groups to be distinguished; one group is termed the redox metals containing copper and iron, and the other group in which there is no change to another oxidation level, *e.g.* nickel and cobalt; within each group there are differences in the strength of the effect.

In beer, part of the isohumulones is so strongly bound by the metals that it can no longer be extracted with organic solvents without the addition of acid to cleave the metal-isohumulone complex. However, after prolonged contact in bottle not all the isohumulones can be recovered by acidification. It is thought that part of the bittering substances is permanently bound perhaps to protein. These effects inevitably result in changes in bitterness as judged by tasting panels. In the present work, for instance, it was found that over a period of six weeks a beer containing 5 p.p.m. of nickel was adjudged to be less bitter, whilst analytical methods showed a greater decrease in isohumulone content when compared with a control. This has also been reported by other workers,[12] who have reported a rather quick and clear change in taste, these nickel-treated beers becoming sharper to the palate.

With reference to past work on the ability of nickel to promote gushing in beer, it may be timely to emphasise that not all instances of over-foaming are due to the presence of traces of this metal. Where nickel has been absent, gushing has been reduced by decreasing the volume of air in the head space of bottles and also by minimising contact between air and beer during bulk transportation. In such instances it seems probable that gushing was due to an oxidative process which was catalysed by traces of iron. This, then, would appear to bear some relevance to the work reported above.

## NON-BIOLOGICAL HAZES

The work of the European Brewery Convention Haze Group on chill hazes reveals that all hazes examined contained leucoanthocyanins. The ash contents ranged from 0·69-2·97%, and the presence of heavy metals other than the expected calcium and magnesium was established whilst they were all shown to possess similar redox potentials ($-300$ to $-400$ mv. at *p*H 6·7). Of other compounds detected, glucose and pentoses were prominent in the carbohydrate fraction whereas glycine, proline and glutamic acid were abundant of 17 amino acids found.

**Chill haze and permanent haze**

The Haze Group defines chill haze as the turbidity which appears when beer is chilled to 0°C. and which disappears on warming again to 20°C. Permanent haze is defined as turbidity, which persists at 20°C. However, there is no clear distinction between the two types; the second may be formed from the first and both are of similar composition.

Among the parent substances responsible for haze formation it is thought that the barley gums may play a part, whilst iron and more particularly copper can exert adverse catalytic effects. The presence of oxygen is also an important factor in the formation of haze.

The presence of leucoanthocyanins in hazes is well established, entering the beer from both malt

and hops. A new approach to the removal of such compounds is being studied at the Brewing Industry Research Foundation. This involves enzymic destruction of this group of substances during mashing.

It appears that during ordinary malting the concentration of anthocyanogens does not change; but if the husks and pericarp are removed before the corns are germinated, it has been found that the amount of anthocyanogens present in the endosperm becomes progressively reduced, suggesting that these substances are enzymatically destroyed during malting. The isolation of the enzyme or enzyme system responsible is now under way.

**Reduction of haze materials**

It is suggested that the selection of an appropriate barley variety is a possible future method for controlling beer haze. In the meantime, by modifying the brewing process it is often possible to achieve a reduction in the concentration of potential haze materials.

It has been suggested that a mash *p*H of 4·9 would decrease the amount of proteins which contribute to haze formation, whilst Hopkins believes that hordein fractions (which play an important role in haze formation) are eliminated at *p*H 5·0. However, despite such precautionary steps in the earliest stages of the process chill haze material can still be formed during fermentation, possibly as a result of yeast autolysis.

In the later stages, two alternatives are available. The use of powdered nylon in tank or incorporated in a filter system has been shown to be very effective in removing the polyphenolic substances or anthocyanogens. In this fashion a substantial extension of shelf-life is attained without any adverse effects upon flavour.

The other approach is to employ chill-proofing material (in the form of enzymes), which is basically papain but with other enzymes present. This treatment produces more stable beers than would be obtained by treating beer with a substance such as bentonite or tannic acid. These latter substances, to be reasonably effective, must be employed at such a concentration that the head retention of the beer is impaired.

**Bulk cold storage tanks play an important role in the quality of bottled beer.**

The presence of metals, such as copper and iron, in combination with high air contents can decrease the effectiveness of these treatments. To reduce the effectiveness of metals in promoting haze development it has recently been suggested that the inclusion of ethylenediamine - tetra - acetic acid (E.D.T.A.) effects an improvement.

**Effect of kilning**

A recent investigation[13] studied the influence of kilning intensity on chill haze. A Proctor barley, of high germinative energy, was malted and the resulting green malt was reduced to 10% moisture content without the temperature of the kiln exceeding 45°C. One-half of the malt was cured at 60°C. for 4 hours and the other half at 80°C. for 4 hours. The wort from the high-cured malt had a greater colour, viscosity and reducing power than the low-cured malt.

Strongly-kilned malt reduces the oxygen sensitivity of the beer caused by tannins and polyphenolases, this effect being enhanced by the increased production of melanoidins. The beer from the high-cured malt was twice as resistant to chill-haze development.

These investigations were prompted by the newer knowledge of the influence of malt husk and hop tannins on chill haze. Obviously, the greater the colour of the malt the greater will be the resistance to oxidation of the beer.

*(To be concluded)*

★ *Progress in 1960* ★

# BAKING Industry

## REVIEW

**By Edmund B. Bennion,* M.Sc.Tech., F.R.I.C.**

*For the baking industry 1960 was a year of consolidation and steady progress, with developments in bulk handling, machinery and equipment, research, legislation and trade organisation.*

DURING the year there have been further acquisitions of smaller bakeries by the large groups but only to a limited extent, maybe because they have already secured most of those worthwhile and who have been willing to sell out. The number of large, privately-owned bakeries is small, but all those which do carry on under their own direction continue to flourish and maintain the support of the clientele in their own areas.

Supermarkets have continued to expand and sell bakers' products and whilst the overall consumption of flour does not increase, in fact the trend is the reverse, it is evident that it is the distribution end of the products which may have changed more than the production end.

### RAW MATERIALS

Progress has been made in the further development of bulk handling of flour, and in the new Milanda Bakery in Edinburgh (see FOOD MANUFACTURE, May 1960, p. 209) the latest installations can be seen.

#### Continuous dough making

More progress in the bulk handling of other products has been made on the biscuit side of the industry where automation and electronic controls lend themselves more readily than in bakeries, and several new plants have been installed during the year.

Following on the bulk handling of flour comes the bulk handling of doughs with conventional and continuous methods of dough making and subsequent manipulation. In this country the two continuous dough making methods which are being developed are the *Do-Maker* process by Wallace and Tiernan and the Strahmann process by Henry Simon, Ltd. (the latter firm have established working relationships with American Machine and Foundry Company so that the range of bakery equipment manufactured by A.M.F. will be available in the U.K. and Eire).

Progress in the introduction of continuous dough making plants in the U.K. is slow. In U.S.A. and Australia the *Do-Maker* plant is forging ahead but as yet there are only a few plants sold in this country. This is no doubt due to the inherent conservatism of outlook of the British not only with regard to the introduction of a different type of bread but also the costs involved in installing such plant and the unwillingness of the accounts departments to write it off after a few years and install other newer plant in its place.

This undoubtedly has been occasioned by the low return from bread in the past, but today with the changing outlook and modes of production, a more realistic approach can be made to plant replacement and modernisation, and when such a change occurs we should see a more ready approach to the adoption of continuous mixers.

There is still much ignorance about the potential of such machines. Many people think that they can only be used with brews as the fermenting agent and must be used in conjunction with the strongest flours and high enrichment percentages. The success which is being achieved in Australia shows that a wide range of flours can be used (certainly not of the strong American type) and experience elsewhere shows that straight yeast liquors and much lower enrichment ratios than has been common in American practice are satisfactory.

The installation of such plants will only be possible in the larger units and not until the matter has been studied very thoroughly will the idea be widely adopted.

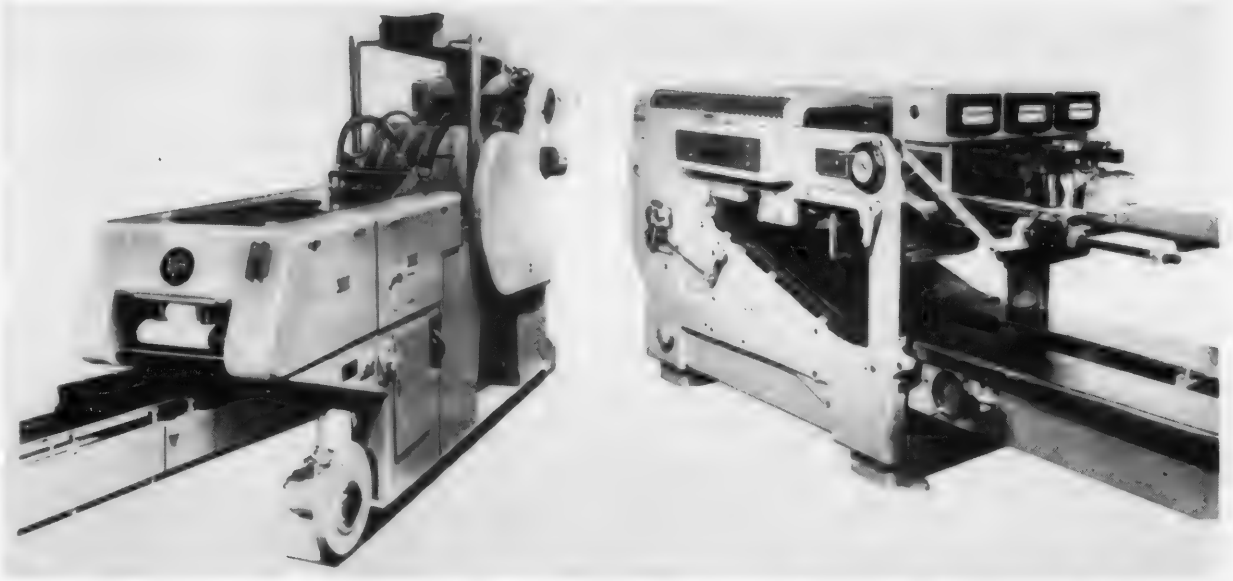
It is, however, interesting to record that continuous mixing machines are arousing interest in many other countries and there are today the Swiss *Buss-Ko* kneader, the Swedish *Ivarson* plant and the Russian Rabonowitch plant in addition to the German Strahmann plant made in this country by Henry Simon, Ltd., and the American *Do-Maker* plant.

#### Flour quality

Flour quality today is more consistent than ever due to the increasing skill of the millers, engineers and cereal chemists who all have contributed to the perfecting of present-day methods of milling.

Following the wet harvesting period, delays were experienced in

* Head of Department of Food Technology, Southampton Technical College.



(*Left*): **Baker Perkins " Double U " moulder panner.** (*Right*): **Forgrove " National " machine for wrapping bread with polythene.**

the harvesting of English wheats, but with the increasing use of combine harvesters, much of the grain was harvested in a reasonably good condition for milling and although moisture contents were high it was possible to dry it out, and as a result not only was it suitable for blending with other wheat but also for milling alone. Much of the all English flour produced at the beginning of the new season was of good baking quality carrying a satisfactory water absorption and capable of producing attractive crusty bread. Many bakers took advantage of this and of the favourable price to use it for blending with the standard bread flours for articles such as buns, rolls and tea cakes and breads which were made on short processes.

Whilst work proceeds on impact milling no big development has yet taken place, but interest is developing in the question of high protein, high ratio flours, for the making of special types of slab cakes.

## MACHINERY DEVELOPMENTS

During 1960 the British Baking Industries R.A. has continued its surveys on equipment commenced during the previous year. This is a most comprehensive and useful piece of work since a list of all available types of each item of equipment are listed along with their sizes, capacities and where possible their actual cost at the time of publication.

During 1960, reel ovens, cake mixers and doughnut fryers have been dealt with so that with the previous publications of 1959 most of the major items of equipment have been dealt with to date.

### Ovens

In an industry which is progressive new items are constantly being introduced, and the Record Bakery Equipment Co. are now marketing an oven of Dutch manufacture suitable for medium and small confectionery establishments. This is the Livako tunnel trolley oven.

The oven is constructed in two sections, each compartment containing two gas burners and a fan to provide air circulation. The sections bake independently, as the gas burners are thermostatically controlled and hot air is circulated which gives each article a rapid and efficient all round bake. It is economical to operate both in labour and operating costs. Six trolleys are supplied with each oven, each one of which will take either 12 or 24 trays. The capacity of the oven is two racks with a maximum of 48 trays.

The articles for baking are trayed and placed on the racks which are moved to the oven when ready. Hence the trolley is linked to the mechanical drive which automatically takes the trolley into the oven, the baking time being controlled by an electrical time switch. The goods when baked are cooled and then removed from the trolley. The time for firing the oven from cold to the average baking temperature is stated to be around 20 minutes.

In the bigger range the Baker Perkins *Turboradiant* oven is being widely adopted in place of the *Uniflow* which has proved so successful in the past. This is heated either by gas or oil which is burnt in a tubular furnace and the products of combustion are circulated through stainless steel ducts and thence to tubular radiators situated above and below the level of the goods which pass through the oven. The gases thus produced transmit a large amount of their heat in this way and after so doing are passed by a circulating fan to the furnaces where they are mixed with the products of combustion and recirculated. This ensures an even and full distribution of heat so that a shorter baking time is possible and

greater economy in fuel consumption.

**Moulders**

Progress has been made in the development of moulders and equipment for producing multi-piece loaves. In view of the labour involved in twisting bread and the faults which occur when inexperienced labour has to be used it is not surprising to find the four piece loaf achieving popularity. Not only is this loaf easy to produce mechanically but the eating qualities are superior to those of twist bread. In this connection the *Double U Moulder Panner* of Baker Perkins not only produces the four piece loaf but delivers it automatically into the pans.

Development of automatic feeding of ovens is going ahead with travelling plate ovens; a pusher gear feeding device from final power to oven can now be incorporated in all new plants. Likewise at the delivery end the loaves can be conveyed to a detinner and thence to a travelling cooler so that at last the whole process of breadmaking can be carried out without any human handling.

## RESEARCH

During 1960 the British Baking Industries R.A. has been carrying on its most useful work and has greatly improved its publications. It has published many useful reports available to members on application—a wise procedure since it ensures economy in costs and prevents wastage from those receiving them automatically who are not interested in the particular topic.

It would be interesting to know what proportion of the total membership avail themselves of these reports which cover the study of factors affecting the production of bread from mechanically developed doughs, comparisons between batch and laboratory scale development, the assessment of the difference in flour quality and of the addition of crumb softening agents on bread characteristics, the Hagberg apparatus for measuring the effect of cereal α-amylase activity in flour, measurement of flour particle size, the assessment of the diastatic activity of flour and fat bloom on biscuits.

**Staling**

In connection with the staling process in bread, studies have been made on the physical chemistry of starch gelation and of the effect of surface acting agents (Surfactants) on it. As a result of micrographic studies using various surface acting agents at various temperatures it would seem that the inhibition of starch swelling is untenable as an explanation of the softening effect of surfactants.

The use of the Brabender Farinograph as a means of measuring crumb staling has been tried, but whilst it has been noted by many workers that when bread crumb is mixed with a standard quantity of water it offers progressively less resistance to mixing as it stales, because of variations in bread formula it cannot be used to provide a standard method of measuring staling.

Much work has been carried out on continuous mixing and dough development and in devising physical dough testing methods for evaluating the properties of flours suitable for use in such processes. Collaborative work with firms using continuous mixers and mechanical developers of various types has proved most helpful, and changes in technique, energy requirements and amended methods of oxidation have been suggested with successful results.

**Flour quality**

Gas chromatography has been employed to study the fatty acid distribution in total flour lipids under a joint scheme with the U.S. Department of Agriculture, and this work is being extended to cover English and Canadian wheats. Protein fractionation methods are being used as a means of studying methods of evaluating flour quality; the preliminary results were published in *Nature*[1] and are most interesting.

Realising the importance of industrial liaison, officers have been calling on members and so great has been the demand for help that an additional officer is to be appointed. The scientific liaison service started at the end of last year has made rapid progress. A mobile laboratory and workshop have been equipped which has proved most valuable in carrying out investigations on the premises of the member requiring help.

**Packaging**

With the increasing use of packaging for all types of bakery goods the chance of mould spoilage increases and so considerable attention has been paid to the study of mould prevention. The use of calcium propionate and sorbic acid have also been studied.

Likewise the use of film wrappings is proving of increasing interest.

## LEGISLATION

The new Weights and Measures bill had been keenly awaited since some relief from the anomalies of the old act were hoped for. During the year we have seen the most absurd prosecution ever of a baker selling overweight bread and an intimation that the new act will be a virtual replacement of the old one without any adequate safeguards for the baker against the errors of his staff or other persons.

**Weights and measures bill**

The draft bill has now been introduced into the House of Lords, and from a perusal of this it is obvious that the various submissions made by the Industry as a whole appear to have been ignored. It is perhaps fortunate that the Industry should be represented in Parliament at this junction, and it is to be hoped that Alderman Edwin Taylor, member for Bolton East, will make his presence felt when the bill comes before Parliament. He is known as a forthright trenchant speaker, and so the industry will await his advocacy with interest. The case for amendment of the act had been

stated so many times that it is difficult to understand why no attempt has been made in the draft bill to meet them.

**Bread and flour report**

The report of the Food Standards Committee on bread and flour was published towards the end of the year, and on first reading the report seems reasonable and fair with no new restrictions on the legitimate trader. The main considerations deal with the advertising and nomenclature of special types of bread, particularly so-called slimming breads containing more or less gluten.

The only change which will affect the average baker will be the designation of milk bread and use of the word "milk" in connection with bread. Nineteen sixty-one may well see the disappearance of the milk loaf from the British baker's shop window and van for ever.

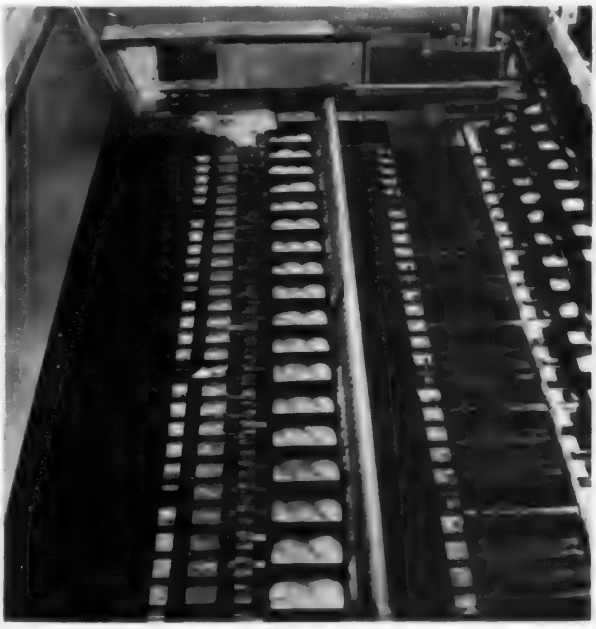
**Delivery of dough pieces to pans in "Do-Maker" plant.**

## TRADE ORGANISATION

Twenty-five years ago reorganisation of the National Association of Master Bakers was under consideration. Some members advocated the formation of regions to co-ordinate the work of the existing County Associations and local associations so that direct affiliation to the National Association could be established. As it was, at that time, individual membership of many associations was weakening the National Organisation.

Now, in the past year, regionalisation has been completed and the director of the National Association of Master Bakers, Mr. L. F. Cadwallader, O.B.E., must be experiencing great satisfaction that eventually this has been accomplished against much opposition in the earlier days and still even today not with complete accord among all the rank and file; that however will come in time.

With such homogeneity a real National Association has been obtained which can now speak for the whole industry and can be in a position to bargain where necessary. Within the structure there will be sections, as is desirable, but in the future in all major projects the industry must act and work as one if it is to survive in the coming years.



**Automatic feeding of ovens; a pusher gear feeding mechanism for oven loading, by Baker Perkins.**

**Craftsman bakers**

The Society of Craftsman Bakers, pledged to further the interest of craftsmen in the industry and promote the sale of oven fresh crusty bread and confectionery straight from the oven, is steadily making progress and has almost reached the thousand mark in its membership. The Society has now started on an advertising campaign.

All bakers belonging to the Society are entitled to use the Society's *Bakamade* trade mark, which will be displayed in the windows of the members' shops. Not only are more family bakers concentrating on crusty breads, but also the plant bakers and delicatessan shops who have small bakery units attached. Crusty bread can today be obtained if people are prepared to go to particular shops who sell it.

**Education**

"Ergonomics" is a new word in the English language and is the name used in connection with the study of man in his working environment. Its aim is to fit the job to the worker, taking into account all the physical and psychological factors which affect him.

Courses are now being organised under the D.S.I.R., and it has been stressed that the successful application of ergonomics depends essentially on the co-operation of the workers and their trade unions. We may have observed the principles under a different name, but it is interesting to note this new approach and in the meantime familiarise ourselves with the name so that we can make an intelligent approach to the problem when the occasion arises.

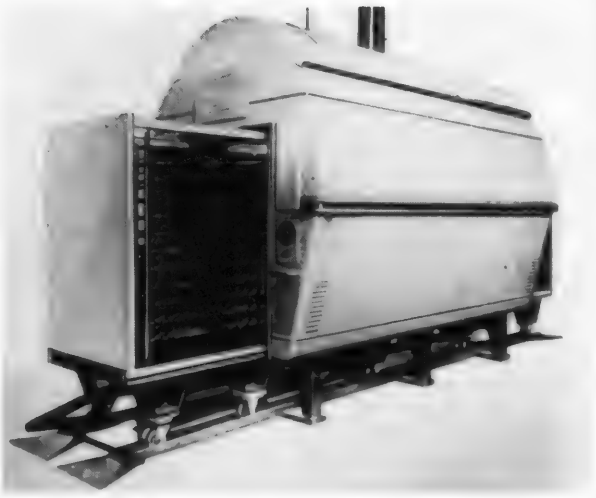
In the field of general trade education there has been a revival of interest in most of the colleges, and in the London area this is largely attributed to the effect of the careers Exhibition held during 1959 at Olympia, at which the Baking Industry had an impressive working stand. This was small by comparison with the heavy industries but so vital and alive with young craftsmen and girls working on it that it was continually besieged, and many enquiries have been made regarding careers in the baking industry.

Apprenticeship also is on the upward trend, and at the end of 1960 this showed an 8% increase on the previous year.

The City and Guilds of London Institute are now revising all their syllabuses and remodelling them on lines to suit the changing needs of the industry. It will be some time before these are put into operation since the drafting work is not yet complete. In the meantime the colleges are aware of the impending changes and so can be making their own preparations for dealing with them which should not present any difficulties in the majority of cases.

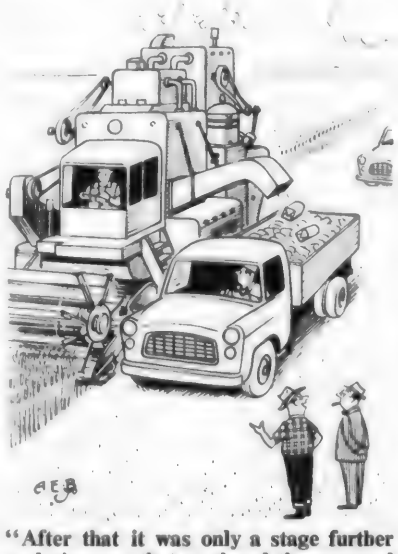
Whilst the number of apprentices is increasing the need is for the industry to formulate a scheme of training within the industry so that the boy or girl gets a good all-round practical training on the job which, in conjunction with the technical training obtained at college, will enable them to be accredited as skilled craftsmen at the completion of their term of apprenticeship.

**The "Livako" tunnel trolley oven.**



Another matter which the industry must also give attention to is the training of young people beyond the apprenticeship stage for management positions. Until such attention is paid to this aspect of training the industry will not be able to have an assured source of trained people capable of taking over the running and management of the many large units now being operated in this country today.

Things are moving fast in the Baking Industry, although sometimes they do not seem to be doing so. As ever there are the usual anomalies common with so many industries. Technological developments are outpacing the training of the people to cope with them. This is particularly felt in the Baking Industry because owing to conditions of employment in the past so many boys recruited have not had the fundamental education to acquire the technical knowledge subsequently to lead them to positions of management. The intake today is improving but is still not good enough, and the industry must take this matter seriously to heart to see how the technicians and the technologists of the future can not only be produced but first of all induced to pursue a career in the industry.



**"After that it was only a stage further to design one that produced the wrapped sliced loaf."**

REFERENCE

1. *Nature*, 1960, **187**, 600.

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▸Installations designed to handle liquid sweeteners in bulk are described in a pamphlet issued recently by Brown and Polson, Ltd. The pamphlet points out the advantages and economies of handling sugars in liquid form, and outlines the basic installations necessary for liquid glucose/sucrose blends and for liquid glucose.

▸A new leaflet issued by British Resin Products, Ltd., describes the growing use of Rigidex high density polyethylene in the important field of packaging, where the introduction of Rigidex high density polyethylene has made it possible to provide packs and packaging methods which could not be achieved as effectively or as economically in other materials.

# ADVANCES in FOOD TECHNOLOGY

**ANALYSIS**

### *Influence of pre-treatment on detection of liver*

Research has been carried out at the Institute for Bacteriology and Histology of the German Federal Institute for Meat Research, Kulmbach, on the influence exerted by different methods of pre-treatment and comminution, and by different temperature limits applied during processing. Pork and beef liver samples, treated in different ways (raw, pre-salted, frozen, pre-scalded, ground, triturated), were heated to different temperature limits, and then histologically tested. After grinding, the liver lobules were still clearly discernible. After comminution in a colloid mill, the only way of detecting liver was from the Glisson tissue and cell detritus. The liver cell nuclei were stained most clearly with those samples in which pre-scalded liver had been used. After comminution of the liver in the colloid mill and sterilisation, the stainability of the cell nuclei was greatly reduced. In all samples, however, it was possible to detect liver or liver constituents, though in some cases only after long and close examinations. —F. Kelch and P. Enders, *Die Fleischwirtschaft*, 1960, **12**, 805.

**BREAD**

### *Effect of lysine on protein quality*

By calculation from previously obtained data, on the growth rate of weanling rats on diets containing white bread as the source of protein supplemented with different amounts of l-lysine, it is now shown that the mean rate of growth is directly proportional to the mean intake of lysine. This applies when the protein content of the diet is 12-13% and the amounts of lysine added are within the range 0-0.25% of the diet. Under these conditions the rate of growth $y$ (g/rat/day) is related to the intake of lysine $x$ (mg/rat/day) by the empirical equation $y = 0.06154x + 0.03$. Growth rates on bread containing (a) wheat germ, (b) skim milk powder, and on bread crust have been measured, and the applicability of the equation to these data has been examined. On bread crust the rate of growth was significantly less than on bread crumb. When the observed growth rates were substituted in the empirical equation the calculated lysine content of the crust indicated a loss of available lysine compared with the crumb of about 20%. The observed rates of growth were comparable with the growth rates calculated from the lysine contents of bread containing added raw wheat germ. Heat processing of the raw wheat germ gave slightly lower rates of growth and food consumption, suggesting a small reduction in available lysine due to the processing. Similar results were obtained with bread prepared with dried milk powders (6% of flour weight).—J. B. Hutchinson *et al.*, *J. Sci. Food Agric.*, 1960, **11(10)**, 576.

**RADIOBIOLOGY**

### *Removal of strontium from milk*

If strontium radio-isotopes become sufficiently concentrated in milk to become a hazard, methods of removal will become important. The ability of bone to sequester strontium ions from fluids has been used to develop a simple process for removing radio-strontium from milk. The method of preparing the bone markedly affects its efficiency; removal of proteins with ethylene diamine, extraction of lipids with a mixture of alcohol and ether, and treatment of anorganic or fat-free bone with 4 N calcium chloride solution are among the more effective treatments. A single column of modified fat-free bone can be regenerated repeatedly, and anorganic bone can be repeatedly reactivated and re-used after calcium chloride treatment alone. About 50% of the radio-strontium was removed by fat-free bone pretreated with potassium hydroxide or by anorganic bone when 1 g. of solid was mixed with 50 ml. of milk for 10 mins. It is concluded that a simple method for the commercial treatment of milk is practical.—L. Singer and W. D. Armstrong, *Nature*, 1960, 186, 485.

**MICROBIOLOGY**

### *Apparatus for studying dry-heat resistance of micro-organisms*

An apparatus is described that makes possible the study of the dry-heat resistance of micro-organisms under controlled conditions of time and temperature in the range 300 to 380°F. (149 to 193°C.). The accuracy of the temperature control system is ±1.0°F. and time ±0.1 minute. The lag correction factor of the sample cups has been evaluated as a function of gas flow for both air and superheated steam. The dry-heat resistance of spores of organism 5230 (similar to *B. subtilis*) to superheated steam has been determined and it was found to have an $LD50_{3m}$ of 2.4 mins. and a $z$ of 42°F.—I. J. Pflug, *Food Technology*, 1960, **14(10)**, 483.

**CURING**

### *Salt diffusion into pork*

In an effort to determine the mechanisms involved in permeation, the effects of time, solution volume and solution concentration on sodium chloride diffusion into pork muscle were studied. Accumulation of sodium chloride varied linearly with solution concentration and volume. The accumulation value-time relationship was logarithmic. An equation correlating the above factors was derived—Wistreich *et al.*, *Food Technology*, 1960, **14**, 549.

**STORAGE**

### *Changes in sterilised food at low temperature*

Results of this study clearly demonstrate that HTST processing methods can give a product which is equivalent or superior to a conventionally canned product with respect to components investigated, and that products processed by either method are materially benefited by storage temperatures below 50°F. There was no evidence that HTST processed products, having an initially higher concentration of reactants, deteriorated faster than similarly conventionally processed canned products.—Brody *et al.*, *Food Technology*, 1960, **14**, 552

## Correspondence

### *World food supplies*

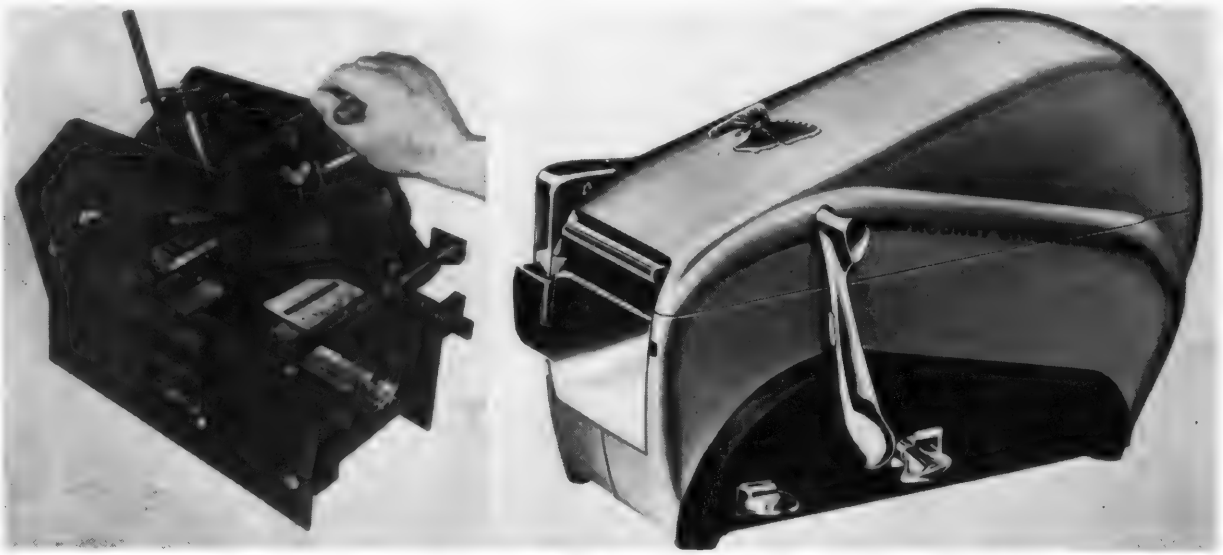
SIR,

Beginning February, 1960, you published a series of articles by Francis Aylward entitled "World Food Supplies." . . . I believe that this is the best exposition of the problem I have seen, and it does finally recognise that there are other food patterns than the "Western" way of eating.

I must admit even in the U.S.A. there are second thoughts about the up-to-now accepted scheme of feeding, and the first victim of this revolution will be the recommended high calorie intake. Even the high calcium requirements are already questioned and a theory of adaptability is being propounded.

V. J. OSWALD,
*Firmenich of Canada, Ltd.*,
350, Wallace Avenue,
Toronto 9, Canada.

# *MACHINERY and EQUIPMENT*



(*Left*): **The Purdy " Prestofix " portable hand labeller for round, flat, square, oval and polygonal shapes with quick adjustment and changeover.** (*Right*): **Samuel Jones and Co. have recently introduced this Rodney " Streamline " automatic machine for moistening and dispensing predetermined lengths of gumstrip sealing tape.**

### HAND LABELLER

A hand labeller, the *Prestofix*, for labelling flat, square, oval and polygonal shapes as well as round, with the minimum of trouble in changing over, has been produced by the Purdy Machinery Co., Ltd. The machine is completely portable. All labelling parts have been designed for quick adjustment and change-over, and are readily accessible for cleaning and servicing. The machine will label bottles or containers of from 2½ in. diameter to 3½ in. diameter, labels being 1½ to 3½ in. deep by 2 to 4½ in. wide. In the case of shapes other than round, maximum container width is 5½ in.

### CAN LABELLING MACHINE

A high-capacity can labelling machine—the MAP/R—which is manufactured by Virano et Fils of France, is now being marketed in the U.K. by Mason and Morton, Ltd. The machine has a capacity of 15,000 to 18,000 c.p.m., and a new non-stop model is also being developed which is expected to give an increased capacity of up to 30,000 c.p.m. Positioning of labels is said to be extremely accurate, and the degree of adhesion is adjustable: an automatic warning system operates when the label magazine requires recharging. An easily-adjustable two-speed control is fitted. The machine is designed for easy accessibility to facilitate maintenance.

The company also manufactures other versions of this machine equipped to deal with a wide range of variously-shaped cans, including oval and rectangular cans, shallow types for sardine, fish, etc., tapered rectangular corned beef tins and tub-shaped containers.

### CARTON FILLER

The *Kanepack* unit carton filling machine produced by Frederick C. Kane, Ltd., is designed automatically to feed a carton in the flat form from a magazine and erect and position the carton for insertion of the product. The product is accepted at the feed mechanism while the carton is being erected, synchronised with the erected carton and mechanically inserted; if required, a leaflet can also be inserted with the product. Carton flaps are then glued or tucked in and the package is ejected on to a collection table between compression guides.

Maximum continuous running speed for a standard single-line machine is 60 filled packages per min. of carton maximum size 3½ × 9 × 4½ in. Minimum package size is variable, but machines can be produced which will erect and fill cartons of ⅜ × ⅜ in. opening section. The machine is capable of inserting products singly into cartons, or in tiers, and is equipped with a " no product—no carton " mechanism.

The machine is powered by a 1 h.p. double-ended shaft, 1,425 r.p.m. motor connected to a speed variator pulley and vacuum pump. Overall dimensions are 7 ft. 3 in. × 6 ft. 6 in. × 3 ft. 10 in. The whole machine is completely enclosed and panelled.

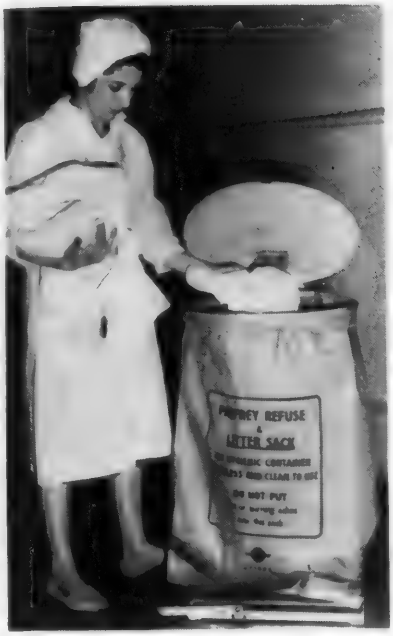
### AUTOMATIC SEALING MACHINE

The Rodney *Streamline* automatic sealing machine has recently been introduced by Samuel Jones and Co., Ltd. Designed to moisten and dispense predetermined lengths of gumstrip sealing tape ready for application for package sealing, the machine gives a full day's continuous use at a single filling. An automatic moisture control unit is incorporated, and the valve maintains a constant water level to ensure all-over moistening of the tape. The machine has a brush weight for even moistening, and incorporates a setting screw for length control. The hinged dust-cover allows easy accessibility.

### METAL-ENDED FIBRE DRUMS

A new series of metal-ended fibre drums for dry and near-dry packaging has recently been introduced by Venesta Plywood, Ltd. Three types of fibre body are available to provide different degrees of moisture protection for dry products. The tube is wound from chipboard and kraft, and base and lid, clinched into the fibreboard without riveting or stitching, are normally made from 27- or 28-gauge steel, finished with a stoved-on epoxide lacquer. The base and lid are specially shaped to provide both secure stacking and maximum impact strength, and the result is said to be extremely strong and durable.

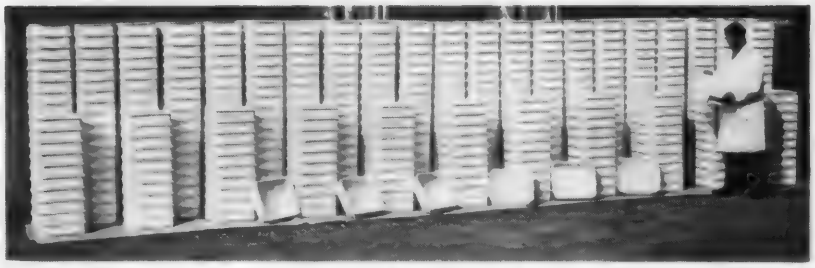
For a greater degree of resistance to moisture and grease, the basic fibre-




*"Palfsacks" multi-wall paper sacks are now being used for collecting refuse and soiled linen, say the makers, William Palfrey, Ltd.*

board construction can be reinforced by the addition of aluminium foil, either bonded to the inner wall, laminated between the separate plies of the wall during winding, or laminated to the outer wall.

The drums are being made in three internal diameters, 14¼ in., 12 in. and 10 in., with bodies of any length up to 38 in., but the company say that other diameters can be produced for reasonably large-quantity orders.



**A stack of tote boxes made from Iridon's high impact polystyrene sheet.**

### STACKABLE TOTE BOXES

Vacuum-formed tote boxes suitable for food factories are lightweight, tough and hygienic. Those illustrated are made from 180 thou. high impact polystyrene sheeting manufactured by Iridon, Ltd. They have underset ribs at the base which give the boxes additional strength and allow them to be stacked and handled easily. A stack of six boxes has been tested with a weight of 3 cwt. without distortion.

Other materials suitable for tote boxes from the Iridon range are PVC and ABS.

### HIGH-SPEED CAPSULE PRESS

A new *F.P.C.P.* high-speed model pleated capsule press with an output of 1,250 dozen/hr. was exhibited for the first time by the makers, Fords (Finsbury), Ltd., at the Brewing, Bottling and Allied Trades Exhibition recently. The result of over two years' research and development work, the new high-speed model doubles the output of the first *F.P.C.P.* model. Overall length is 60 in. A newly-designed foil feed mechanism is incorporated: twin foil holders, each capable of taking up to a 12 in. diameter reel, are mounted one at each end of a vertical support arm which pivots centrally on a horizontal shaft. When the upper foil reel is exhausted a simple release allows the support arm to pivot, causing the upper reel holder to swing down and the lower to swing up into the operating position. The makers claim that this model can be installed in any existing bottling line, and can handle any conventional bottle size. The press has its own 2 h.p. motor in the base unit, which also encloses the variable speed drive, and overload protection is provided by two Fords torque limiters.

### SELF-BAKING PLASTIC COATING

Developed in the U.S.A., a new self-baking plastic coating has recently been introduced into the U.K. by the distributors, Acalor (1948), Ltd. The material, known as *Liquid Tile*, was originally designed as a heavy-duty resistant coating for architectural use, but has since found wide application in the food industry and in many other fields.

It is applied by brush, sprayer or roller directly to the foundation surface, and sets to a tile-hard inner finish by chemical heat generated by a catalyst which is added to the material before use. It is said to provide a completely monolithic unbroken wall coating which is easily cleaned, and to have a resistance to impact many times greater than ceramic tiles.

The coating is solvent-free and when cured is also free of odour and toxins. Having no mortar joints, the coating is suitable for use in food processing and handling establishments: it is said to be completely non-porous, and will not support bacteria growth.

**The seamed-on steel bottom, joined to the fibre body wall without riveting or stitching, is clearly visible in this picture of the new drum for dry goods packing made by Venesta Plywood, Ltd. Both base and lid are specially shaped to provide safe stacking and maximum impact resistance.**

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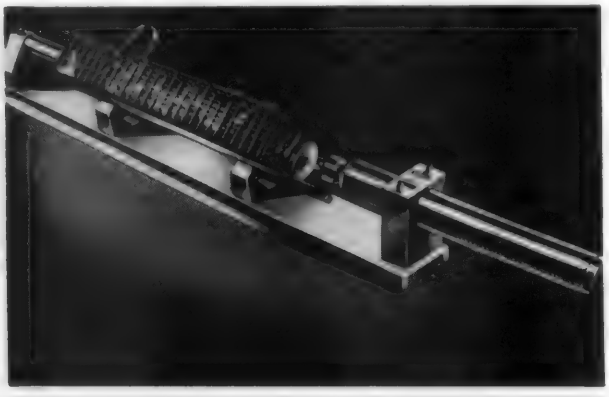
▸Bound Brook Bearings, Ltd., have issued a new catalogue describing their *Lubrook* and *Ferrocite* oil-retaining bearings. The catalogue includes a table showing standard limits and tolerance of various types of bearings, some installation data and a table of bearing specifications, together with information about strength and performance under various operating conditions.

*New pack designs from the studios of the Metal Box Co., Ltd.* (Left): *The range of cartons made by the company's Paper Group for Hales Home Bakeries, Ltd., has been completely restyled. A background colour combination of blue and white runs throughout the range; type faces and layout have been carefully chosen to suggest quality and freshness.* (Right): *The label for this new product from Clonmel Foods, Ltd., is printed by the company's Paper Group and an appetising and realistic effect has been achieved by the four-colour "Lithesk" process despite the difficulty of adequately picturing cooked or raw meat.*

## Improved meat wrapping

Specially developed for improved meat wrapping by British Cellophane, Ltd., is a new type of polythene-coated film consisting of a base of 300 gauge cellulose film with an extrusion coating of 0·0003 in. thickness of polythene. Designated 3P03, it is claimed to be superior to any other film for wrapping fresh meat, being particularly suitable for the larger cuts. Among its commendable properties, say the makers, are: ease of handling; requires no major capital outlay on equipment (the standard BCL Bias-Wrap and Sealing Aid can be used if its heat bar is coated with a barrier material such as PTFE; best sealing temperature is 200-220°C.); does not tear easily or crack on sharp bone ends; tough, and forms a strong heat-seal which does not break down under frequent handling; longer colour and flavour retention; moistureproof; transparent, glossy and free from wrinkles. Labels can be applied in the usual way and remain firmly fixed.

Ideal storage conditions for the film until ready for use are a temperature of 68±5°F., and a R.H. of 40±5%. The wrapped meat is best displayed when the display cabinet is set at 32-34°F.



**The new Viskase "Tite-press" for square-shaped hams, showing (*top*) a ham in position, with the spring at right and a U clip at top left of cage. (*Bottom*): The new shape in hams produced with the press.**

## Square shape for hams

Attempts to produce square hams have not always been entirely satisfactory because of the difficulty of eliminating air and jelly pockets. Viskase, Ltd., have now introduced the *Tite-press* method featuring a two-way compression of the meat which continues during processing. The ham is stuffed out into a Viskase fibrous casing using a *Metapress*, which can be supplied through Viskase. The casing is not clipped, but is placed in a special cage, and two simple spring plates are inserted one into each end of the cage. The whole assembly is then placed in the *Tite-press*, which applies pressure at both ends, and two large U clips are placed into the cage holding the plates in position under pressure. The ham is then cooked or smoked in the cage, the latter being removed after processing.

# NEWS DIGEST

## Labelling regulations for "filled milk"

New regulations, entitled the Skimmed Milk with Non-Milk Fat Regulations, 1960, have been made by the Minister of Agriculture, Fisheries and Food and will come into force on September 19, 1961; they control the labelling and advertising of skimmed milk with non-milk fat, and the same product in condensed or dried form, these products being defined by reference to their appearance and constituents.

The regulations:

(*a*) require labels and advertisements for the "specified foods" to bear the words "Skimmed milk with non-milk fat" (or certain specified alternatives);

(*b*) require labels for the "specified foods" to bear the words "Unfit for babies" or "Not to be used for babies," except that (i) where the kind and amount of fat used is specified the words "Should not be used for babies except under medical advice" may be substituted and (ii) in the case of the foods listed in the Second Schedule none of these declarations about baby feeding is required provided that the food conforms to the compositional requirements laid down for it in that Schedule:

(*c*) require any label for a "specified food" which carries a claim in relation to coronary disease to bear also a statement of the kind and amount of fat used;

(*d*) prohibit, subject to certain savings, the labelling or advertising of the "specified foods," and beverages containing skimmed milk, in a manner suggestive of milk or anything connected with the dairy interest; and

(*e*) provide that the Condensed Milk Regulations, 1959, and the Public Health (Dried Milk) Regulations, 1923 to 1948, shall not apply to any "specified food."

The requirements of subsection 3 of section 109 of the Food and Drugs Act, 1955, will not apply as respects any proceedings instituted by a council for an offence against the regulations.

The provisions relating to baby feeding and coronary disease have been recommended or endorsed by the Committee on Medical and Nutritional Aspects of Food Policy.

*Long service awards were presented to members of the staff of the London Fumigation Co., Ltd., who had completed 25 or more years with the Company. The presentations were made by Mr. D. A. Gates, chairman and managing director, at a party held on December 16 at the Leadenhall Club, London. A presentation was also made to Mr. S. Farrow, who has been a director since 1955. In the picture* (l. to r.) *are Messrs. F. Golding (sales representative), E. S. Mundy (sales representative), W. Morgan (branch manager), D. A. Gates, S. Farrow, E. E. Phillips (branch manager), and A. C. Filby (pest control operator).*

### International Congress of Food Science and Technology

Further to the news of the First International Congress of Food Science and Technology to be held in London from September 18 to 21, 1962, which we recently published, the meetings will be held at the Imperial College of Science and Technology, London, S.W.7.

Further information may be obtained from the Hon. Sec., 1st International Congress of Food Science and Technology, c/o the Society of Chemical Industry, 14, Belgrave Square, London, S.W.1.

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## *News from Scotland*

### Smedley's to consolidate Scottish activities

Smedley's, Ltd., are to close their Coupar Angus factory at the end of its current programme and increase activity at Dundee and Blairgowrie. New machinery is meantime being installed at these two factories to give increased freezing capacity. At Dundee, additional cold storage is being constructed to take 1,500 tons. The Coupar Angus staff will be offered work at the Blairgowrie factory. Mr. Carr, manager at Coupar Angus, will become production manager at Blairgowrie. Mr. Beeton, manager in charge of production at Blairgowrie, meantime becomes general manager at Blairgowrie.

### Fraserburgh cannery expansion

Maconochie Bros., Ltd. are to expand at their Fraserburgh Cannery. Details are still tentative, but a considerable expansion of work is indicated. Increased fish-canning is indicated and additional production lines are a possibility. Buildings used for storage will be converted to production. Last year, the company sponsored a pea-growing scheme with North-East farmers, which was completely successful. Expansion is anticipated this coming year.

### New Aberdeen food factory

National Fishcuring Co., Ltd., who already operate two plants in Aberdeen are negotiating for a new food processing factory and cold store on the Tullos Industrial Estate at Aberdeen. A site covering four acres has been requested, and Aberdeen Corporation has recommended the development in principle. This development follows the building up of available ground in Aberdeen Harbour area and will result in the gradual building up of a new plant in the Tullos area.

# Lords debate Weights and Measures Bill

A proposed amendment to the new Weights and Measures Bill which, according to a Government spokesman, would have given even greater powers of control over packaging than were used in the war, was put forward in the Lords during the Committee Stage.

This was a proposal aimed at the prohibition of deceptive containers. Its sponsor, Lord Shepherd, asserted that many goods were on sale today particularly in the supermarkets, where the customer buying packaged goods was grossly misled as to the quantity.

A demand was made that the Bill should be strengthened to enable the Board of Trade to lay down regulations covering the shape, size and material of containers used in the sale of some goods.

For the Government, Lord St. Oswald turned down the idea. He pointed to two effective safeguards against deception which were already contained in the Bill. They were: (1) a general requirement to mark containers with the quantity of the contents; and (2) a requirement that certain goods must be made up in specific weights. He feared the effect of the amendment might be to stop manufacturers passing on to the consumer the benefit of economies.

Canned fruit was one of the many commodities mentioned in the debate. Lord Burden protested at a situation where one tin contained 16 oz. of fruit and another contained 14 oz. of fruit and 2 oz. of juice. The second canner was taking an unfair advantage.

Eventually the amendment was withdrawn.

Opposition peers also sought to remove the exemption in the Bill given to pre-packed meals. Lord Latham said it had limitless possibilities of abuse, and inquired whether, for instance, potato crisps with salt, buttered biscuits or cereal with a small packet of sugar constituted " an assortment of food pre-packed together for consumption as a meal."

Lord St. Oswald, the Government spokesman, pointed out that if the amendment were carried it would mean that the ordinary luncheon sandwich pack would have to be marked with the separate weights of the bread, meat, biscuits, cheese and tomato. It was carrying consumer protection too far, he suggested. This amendment was also withdrawn.

### Milk testing

Another question for the Ministry was what consideration had been given to the need for combining a protein test for milk with a butterfat test.

Mr. Vane said that the Minister, Mr. Christopher Soames, and his colleagues were awaiting the comments of representative organisations on the report of the Cook Committee before reaching any conclusions about the criteria to be used for testing milk for compositional quality.

### Leiner's battle against floods

The floods in mid-December covered the Leiner plants on the Treforest Trading Estate, Glamorgan (*see* FOOD MANUFACTURE, *August*, 1960, *p.* 319), to a depth of 5 ft., ruined entire stocks of gelatine and put the plants temporarily out of action. The mechanical and electrical installations were the most affected. Fortunately, large supplies of raw materials missed the flood catastrophe, and production started again on December 27.

### B.B.I.R.A.'s new laboratory nearly finished

Work on the new laboratory wing under construction for the Baking Industries Research Association at Chorleywood is now nearing completion and it is hoped shortly to begin the installation of technical equipment and pilot scale bakery equipment.

Mr. Trevor A. Bowen, D.L., J.P., will open the new building at 3 p.m. on Thursday, April 27, next.

All engaged in the baking industry are invited to be present on this occasion and it is hoped that those interested will now make a note of the date.

**"How do you like our new advertising slogan, Mr. Smelford?"**

## Recent Patents

856,790. KOOPMANS MEELFABRIEKEN N.V.: Process for the production of farinaceous foods which are ready for immediate use.

857,442. SACK FILLERS, LTD.: Sack or bag filling apparatus.

857,517. UNILEVER, LTD.: Beverages.

857,521. PLASTUS S.A.: Manufacture of thermoplastic bags.

857,031. ROSE BROS. (GAINSBOROUGH), LTD.: Bag-making machines.

857,032. H. D. JUSTI AND SON, INC.: Dough compositions.

857,608. FORDS (FINSBURY), LTD.: Metal foil caps for bottles or the like.

858,007. FOOD MACHINERY AND CHEMICAL CORPORATION: Packaging-machines.

857,699. HAWTHORN-MELLODY, INC.: Sterilised flavoured milk drinks.

857,700. HAWTHORN-MELLODY, INC.: Method for stabilising sterile milk products against gelation.

857,720. REED CORRUGATED CASES, LTD.: Boxes or like containers.

857,954. DAIRY SUPPLY CO., LTD.: Instrument for measuring the fat content of skimmed milk.

857,805. M. FAIREST, LTD.: Labelling-machines.

858,008. FOOD MACHINERY AND CHEMICAL CORPORATION: Packaging machines.

858,009. FOOD MACHINERY AND CHEMICAL CORPORATION: Conveyors.

858,010. FOOD MACHINERY AND CHEMICAL CORPORATION: Machines for tamping and perforating articles such as pies.

858,174. SIMPLEX ELECTRIC CO., LTD.: Electrically heated chambers for cooking or warming food.

858,660. UNILEVER, LTD.: Flavouring substances and their preparation.

858,333. UNILEVER, LTD.: Flavouring substances and their preparation.

858,661. NATIONAL RESEARCH DEVELOPMENT CORPORATION: Aeration of liquids.

858,215. UNIPAK CARTONS, LTD.: Cartons.

858,434. H. NARAGHI: Apparatus for gathering eggs from depositing troughs or channels.

858,465. AKTRON, INC.: Means for positioning cans uniformly on a conveyor belt or band.

858,253. I. S. PHILP: Food compositions.

858,380. K. OSTERTAG: Malting.

858,454. DIAMOND NATIONAL CORPORATION, formerly DIAMOND GARDNER CORPORATION: Moulded pulp egg cartons.

858,379. A. HULSHOF: Process for the preparation of a buckwheat foodstuff which is immediately fit for consumption.

858,340. W. W. TRIGGS (Ched-O-Matic Corporation): Cheese making.

858,343. R. T. TOWNSEND: Sausage stuffing machines and the like.

858,654. R. S. WADDINGTON and B. DUVAL: Apparatus for mixing liquids.

858,655. R. S. WADDINGTON and B. DUVAL: Apparatus for mixing liquids.

859,212. DAIRY SUPPLY CO., LTD.: Control of refrigerating apparatus.

858,898. E. SERAGNOLI and A. SERAGNOLI (trading as SOC. G.D. IN ACCOMANDITA SEMPLICE): Mechanism for feeding strips of wrapping material into a wrapping machine.

*New patents are from the Journal of Patents. Permission to publish has been given by the Controller of Her Majesty's Stationery Office. The publication is obtainable from the Patents Office, 25, Southampton Buildings, London, W.C.2.*

*An embarrassing problem facing 23 Cambridge University students was what to do with £64 worth of powdered soup, weighing 2 cwt., which they had bought to enable them to enter a £5,000 competition. The permutation entry they had worked out required the purchase of that amount. Presumably they did not win the competition, otherwise we would have been told, but Ross Group, Ltd., got them out of their predicament by buying the soup powder for distribution among the company's trawler fleet. The picture shows some of the students carrying the soup from their rooms to Ross's collecting vehicle.*

## Replacement for Preservatives Sub-Committee

The Food Standards Committee has appointed a Food Additives and Contaminants Sub-Committee to replace the Preservatives Sub-Comittee, which has now completed the work for which it was set up in 1951. The terms of reference of the new committee are:

"To consider problems referred to the Sub-Committee by the Food Standards Committee in relation to all substances added to food, whether deliberately or not."

The membership of the new Sub-Committee is as follows:

*Sir Charles Dodds, M.V.O., M.D., D.SC., F.R.C.P., F.R.I.C., F.R.S. (chairman); *C. A. Adams, Esq., C.B.E., B.SC., F.R.I.C., Barrister-at-Law; *A. Glover, Esq., O.B.E., M.SC., F.R.I.C.; *W. A. Godby, Esq., M.B.E., F.R.I.C.; *E. B. Hughes, Esq., D.SC., F.R.I.C.; *J. M. Johnston, Esq., C.B.E., M.D., F.R.C.P. (ED.), F.R.C.S. (ED.), F.R.S.E.; Prof. A. Kekwick, M.A., F.R.C.P.; *H. E. Magee, Esq., M.B., D.SC., M.R.C.P.; P. McGregor, Esq., B.SC., F.R.I.C.; *J. R. Nicholls, Esq., C.B.E., D.SC., F.R.I.C.; and *Prof. B. S. Platt, C.M.G., M.SC., M.B., CH.B., PH.D.

(Those members marked with an asterisk were members of the Preservatives Sub-Committee.)

### Food hygiene courses

Three-day full-time courses are to be conducted at the Royal Institute of Public Health and Hygiene. These comprise a series of lectures delivered by medical officers of health, bacteriologists and public health inspectors.

Food hygiene film strips are incorporated and a brains trust made up from the panel of lecturers is held at the end of each series to answer any queries.

At the commencement of a course each candidate is provided with a set of notes which has been specially compiled to assist in following the lectures leading to the examination.

Written and oral examinations are held at the end of a series of courses—two hours being allowed for the written paper and 10-15 minutes for the oral examination which is conducted by a medical officer of health.

The fees for each candidate are as follows:

Course of instruction £3 3s. 0d, examination fee: £1 11s. 6d.

The dates of the forthcoming series are:

Course no. 1: Monday to Wednesday, February 20-22; course no. 2: Monday to Wednesday, March 6-8; course no. 3: Monday to Wednesday, March 20-22, 1961; examination date: Monday, March 27, 1961.

Details from Secretary, Royal Institute of Public Health and Hygiene, 23, Queen Square, London, W.C.1.

### Arsenic in brewers' yeast

An amendment to the Arsenic in Food Regulations increase from 2·0 to 5·0 p.p.m. the maximum amount of arsenic permitted in brewers' yeast intended for use by manufacturers in the production of yeast products. The limit for the final product when sold to the public and for all other yeast and yeast products remains at 2·0 p.p.m.

*Technical Press Review*

## Modern Trends in Heat Exchangers

This month's issue of **Chemical and Process Engineering** reviews modern trends in heat exchangers: two of the aspects covered are, "Some Design Principles for Heat Exchangers" and "Transient Performance of Heat Exchangers." Other articles include, "Simultaneous Heat and Mass Transfer—II" and "How Stainless Steel is Made."

Food manufacturer readers will be interested in "Recent Advances in Filling and Capping Machine Design" in **Dairy Engineering,** which also contains articles on "Mechanised Cheesemaking in Australia" and a report on the U.S. Dairy Show.

**Paint Manufacture** surveys fluid handling plant. Among other articles are "Flooding and Floating in Paints—II" and "Cashewnutshell Liquid and Cardinol."

Reinforced plastics play an increasingly large part in food processing, handling and storage, and **Fibres and Plastics** deals with "Spray Moulding Techniques for Reinforced Plastics": other articles which are of special interest to food manufacturers include "Glass Fibre Reinforcements" and "Properties of Resin/Glass Fibre Mouldings."

**Petroleum** includes articles on "Lighting in the Petroleum Industry," "Disposal of Refinery Acid Sludge—II," and two specially commissioned articles on drilling mud problems.

"Packaging Materials and Machinery" is the subject of a special review in **Manufacturing Chemist.** Other articles in this issue include: "Gelatin Capsule Manufacture," "Carbohydrates in the Chemical Industry—II," and progress reports on perfumery and essential oils, antibiotics and disinfectants.

**World Crops** reviews agricultural chemicals and fertilisers. Articles include: "Chilean Agriculture," "Fertilisers and Food Production," and "Medicinal Plants in Hungary."

"Computers and the New Technology" is the title of an article in **Automation Progress.** Among other articles are: "Automated Gear Production" and "Hydraulic Servomechanisms—II."

*Specimen copies of these journals can be obtained by writing to the Circulation Manager, 9, Eden Street, London, N.W.1.*

## OBITER DICTA

● If the H-bombs don't get you, then the poison sprays will. —*Reynolds News.*

● Apparatus for decapitating a boiled egg.—*The Official Journal (Patents).*

● I loathe crusty bread. My stomach is O.K.—*Letter in Daily Telegraph.*

● Coalminers are taking home bottles of Beaujolais to drink while they watch television.—*Sunday Times.*

● Today, the age of the Affluent Society, it is officially impossible to die of starvation in this country.—*The Times.*

● I regard clothes as my husband regards food—necessary but not to be discussed.—*Lady Dorothy Macmillan, quoted in Daily Telegraph.*

● Life is like a boiled egg—as soon as you look at it closely, it flies out of the window.—*Livy, quoted in Daily Telegraph.*

● Young butchers should beware of wine, women and cars when they get their own businesses.—*Alderman J. Wilkinson of Bradford, quoted in Meat Marketing.*

● The fastidious King and Queen of England made headlines by eating hot dogs during a picnic lunch at the Hyde Park estate of F.D.R. in 1939.—*American house journal.*

● Anyone who mixes curries, or works regularly with them, will never catch cold. In fact, cold germs just haven't a chance when you are smelling the aroma of these spices.—*Press handout.*

● At a recent exhibition in Copenhagen we tried cold tea to simulate whisky. That was so realistic the Danish revenue men insisted on opening a 200 l. still to taste whether it was alcohol. The tea had been stewing for a week and their expressions were a study.—*Mr. J. G. Window, Sales director of QVF, Ltd.*

● My Tea is No-tea, which is not No-tea in opposition to Tea. What then is this No-tea? When a man enters into the exquisite realm of No-tea he will realise that No-tea is none other than the Great Way itself.—*A Japanese master quoted in Daily Telegraph.*

● On my first evening in Moscow I was warned against the new atomic vodka—"When an Englishman drank it his hands and feet dropped off; an American who took a drink of it disappeared entirely; but a Russian drained his glass and threw it away saying 'Bah, they've diluted it!'"—*Sunday Times.*

### New Buxted factory in Essex

Outline planning permission has been granted for the building of a new 35,000 sq. ft. chicken-processing factory by the Buxted Chicken Co., Ltd., at Boreham, in Essex.

There is already a small factory on the site and it is planned that the new plant which replaces it, and which will have a capacity of 100,000 birds a week, will begin operations late this year.

### British Standard for testing efficacy of "quats"

The purpose of a new British Standard (B.S. 3286:1960), which is based on a procedure developed by the British Disinfectant Manufacturers' Association, is to enable a similar method to be used in every laboratory evaluating the disinfectant activity of quaternary ammonium compounds and their formulations.

Essentially the prescribed technique comprises adding a suspension of viable micro-organisms to solutions containing one or more concentrations of quaternary ammonium compound, and determining the numbers of organisms surviving after a period or periods of time.

### N.I.F.E.S. courses on oil-firing

Three-day courses on fuel oil-firing are to be held at N.I.F.E.S. Office, Ailsa House, Kings Road, Reading, during March, May, June, September, November and December, 1961.

The courses are designed to meet the needs of industrial plant engineers, heating engineers and supervisory staff responsible for oil-fired boiler plant.

The fee for the course, exclusive of hotel accommodation, will be six guineas. Application forms and a course syllabus may be obtained from the National Industrial Fuel Efficiency Service, 71, Grosvenor Street, London, W.1.

## Forthcoming Meetings

**S.C.I. Food Group,** 14 Belgrave Square, London, S.W.1; Wednesday, February 8, 18.15: Nutrition Panel Meeting, "Nutritional Problems in Group Feeding"; Wednesday, February 22, 18.15: "Microbiology of Deep Frozen Foods" (joint meeting with Microbiology Group).

**Institution of Plant Engineers,** Hotel Leofric, Coventry, February 14, 19.30: "Increasing Use of Pack Vending Machines"; Engineers' Club, Albert Square, Manchester, February 14, 19.15: "Introduction of Planned Maintenance Systems."

**Institute of Brewing,** Old Swan Hotel, Harrogate, Friday, February 24, annual banquet of Yorkshire and N.E. Section.

### Courses for buyers

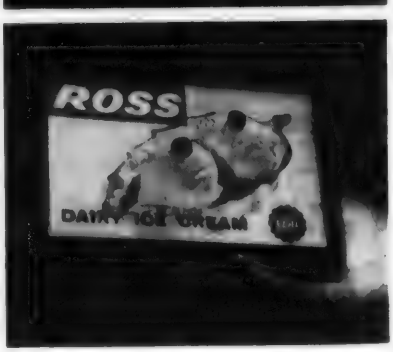
In co-operation with the Institute of Packaging, the Purchasing Officers' Association are running a course for buyers of packaging at the Connaught Rooms, London, W.C.2., on Tuesday and Wednesday, February 14 and 15, 1961.

In addition to the various general courses they run for buyers and stores controllers, the Purchasing Officers' Association also have a course for buyers in the food manufacturing industry, which will be held at the Connaught Rooms, London, W.C.2, on Thursday and Friday, February 16 and 17, 1961.

The fee for each course is ten guineas and further information may be obtained from the Purchasing Officers' Association, Wardrobe Court, 146a, Queen Victoria Street, London, E.C.4.

### New ice cream ingredient

Advita, Ltd., announce the introduction of *Adnul* 150, a new product for the ice cream industry which is a combined emulsifier, stabiliser and flavouring medium. The three constituents are supplied in an accurately balanced mixture claimed to save time and reduce the risk of formulation errors. It is said to be suitable for any kind of ice cream.




*Recent additions to the Ross range are Haddock in Cheese Sauce, an 8-oz. portion, boneless, skinless and in its own container ready to heat and serve, and Dairy Ice Cream, a 17 fl. oz. pack produced by the Ross subsidiary Tudor Dairies, Ltd.*

# PEOPLE

SIR ROBERT BARLOW retired from the chairmanship of the Metal Box Co., Ltd., on December 31, 1960, and has been appointed honorary president of the company. He has also retired from the chairmanship of the Metal Box Co. Overseas, Ltd. He remains a director of both companies.

SIR HAROLD ROXBEE COX has been appointed chairman of both companies.

As a result of assuming these new responsibilities Sir Harold has had to reduce his other commitments and particularly regrets that he has had to resign from the Board of Wilmot Breeden (Holdings), Ltd.

■

MR. G. S. SUTCLIFFE became chairman of Turner Brothers Asbestos Co., Ltd., on January 1 and relinquished the chairmanship of Ferodo, Ltd.

■

MR. ALAN POTTER has been appointed general sales manager of Lansing Bagnall Ltd., the materials handling equipment manufacturers.

MR. EDGAR HARRY WHEELER has been appointed export sales manager.

MR. CHARLES ARTHUR BARR has been appointed manager of the company's technical services division.

■

MR. CHARLES TANNER became a director of T. M. Duché and Sons (U.K.), Ltd., on December 13.

■

MR. T. J. P. ROBERTS, sales director of T. Wall and Sons (Ice Cream) Ltd., is taking over a new appointment as marketing director of the Unilever ice cream interests in Australia.

MR. J. C. SHORT, who has been acting as commercial sales director, will re-assume the responsibility of sales director.

MR. D. W. BARCLAY, who has been in Australia for the last two years on behalf of Unilever, is returning to Wall's as commercial services director.

■

MR. JOHN L. WOOD has been appointed the Buxted Chicken Co's. area sales manager for the Midlands.

■

MR. C. F. SEDCOLE, factory general manager of Birds Eye Foods, Ltd., at Grimsby, is joining the board, replacing MR. E. HALL who was recently appointed chairman of Solo-Feinfost G.m.b.H., Unilever's quick-frozen food firm in Germany.

MISS LOUISA G. GIBB, factory general manager at Birds Eye's Kirkby factory near Liverpool, is taking up a post in London. Her place is being filled by MR. A. R. MANN, hitherto production manager at Grimsby. The new factory general manager at Grimsby will be MR. E. W. WATSON.

**Mr. D. Bradley**

**Mr. A. M. H. Davies**

**Mr. Jack Clark**

**Mr. H. D. Rainbow**

MR. DOUGLAS BRADLEY, M.SC., B.SC., A.M.I.CHEM.E., has been appointed technical manager of Sharples Centrifuges, Ltd. He was previously with the U.K.A.E.A.

■

MR. A. M. H. DAVIES, managing director of Fibreglass, Ltd., has been elected chairman of the Institution of Works Managers. For a time he was formerly assistant commercial manager at the Billingham works of I.C.I. and later works director of H. P. Bulmer, Ltd.

■

MR. F. D. PALMER has joined Fropax, Ltd., as transport manager. He was formerly distribution manager for David Greig, the provision merchants, and before that chief transport officer for the Fatstock Marketing Corporation.

■

MR. RONALD CLOUGH, A.M.I.MECH.E., has been appointed Scottish area manager of George Porteus and Sons (Leeds), Ltd., on the opening of their branch office at 15 Barnton St., Stirling, on January 1.

■

MR. H. ROY THIELE has been appointed as deputy to the advertising manager of the Morgan Crucible Co., Ltd. He was for many years personal assistant to the advertising manager of the Champion Sparking Plug Co., Ltd., and is an associate member of the Incorporated Advertising Managers' Association.

■

MR. C. W. ALLIN has resigned from the board of Redler Industries, Ltd., and its subsidiary companies.

■

MR. J. TAVARE has been appointed a director of Thames Board Mills, Ltd. He will continue to be responsible for the sales organisation of the company.

■

Bowyers (Wiltshire Bacon), Ltd., have acquired the Beechwood Meat Products factory at Plymouth of Brown, Wills and Nicholson, Ltd. MR. L. H. KNIGHT will leave Brown, Wills and Nicholson to join Bowyers and continue as manager of the Plymouth and Plympton factories.

MR. JACK CLARK, fitter's mate at the A.P.V. Co., Ltd., recently retired after more than 50 years' service with the company. He joined Dr. Richard Seligman as "tea boy" a few months before the company was formed in 1910.

■

MR. H. D. RAINBOW has been appointed field sales manager of Three Cooks, Ltd., for the Midlands and Northern Counties. He has been with the company since 1948.

■

MR. N. W. EVAMY has been elected deputy chairman of the Southern Regional Council of the Federation of British Industries. He is managing director of Three Cooks, Ltd., which he joined in 1936, and is a member of the council of the F.M.F.

■

MR. LOUIS KERSHAW, the northern representative for Stevenson and Howell, Ltd., is retiring after thirty-five years' service with the company.

He is to be succeeded by his son-in-law, MR. STANLEY DYER.

■

MR. H. NELSON, who for 30 years has been manager of W. and R. Jacob and Co.'s biscuit depot at York Road, Leeds, has been appointed manager of the firm's newly constructed depot at Plympton, near Plymouth, in succession to MR. J. MILNES, who is retiring after 53 years' service with the company.

MR. T. CHESTERMAN from Liverpool has been appointed manager of Leeds depot.

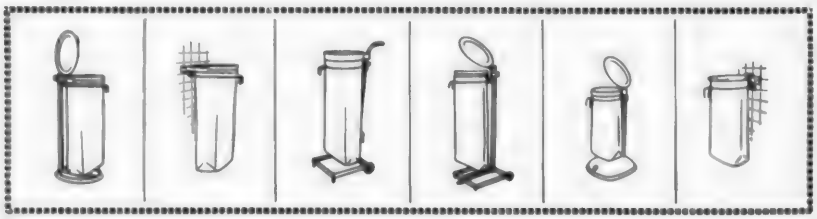
## Obituary

The death has occurred at his home, Bearsden, Glasgow, of MR. JOHN RONALD YOUNG (74), a former director of Macfarlane Lang and Co., Ltd., and of United Biscuits, Ltd. Mr. Young, who was a chartered accountant, joined Macfarlane Lang and Co., in 1923 and became secretary in 1948. In that year the interests of the company were acquired by United Biscuits, Ltd., and Mr. Young became a director.

# give waste bins the sack

**DISPOSABLE PAPER SACKS REPLACE BINS AND REVOLUTIONIZE WASTE COLLECTION**

This is the modern system of waste collection. Tough, wet-strength Medway multi-wall paper sacks suspended from Cartem metal holders. When full, the sack is simply detached, closed, taken away—and a brand-new clean, fresh sack fitted. No mess. No smells. And the filled sacks are so easy to handle, too, because there's only the weight of the contents to carry—no cumbersome bin. There are places for the Medway-Cartem system everywhere. Factory shop floors. Kitchens. Surgeries. Canteens. It brings new standards of efficiency and hygiene wherever there's waste to collect. The holders come in a full size-range, mobile and static, with manual or foot-operated lid. And the sacks can be specially colour-coded for immediate identification of sack contents.
SEND FOR FULL DETAILS.



*Sack-holders manufactured and supplied by Cartem Engineering Ltd., London, under Patent Number 809109*

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Reed Packaging Division

**REED MEDWAY SACKS LIMITED (DEPT. F M 1)**
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# OVERSEAS NEWS

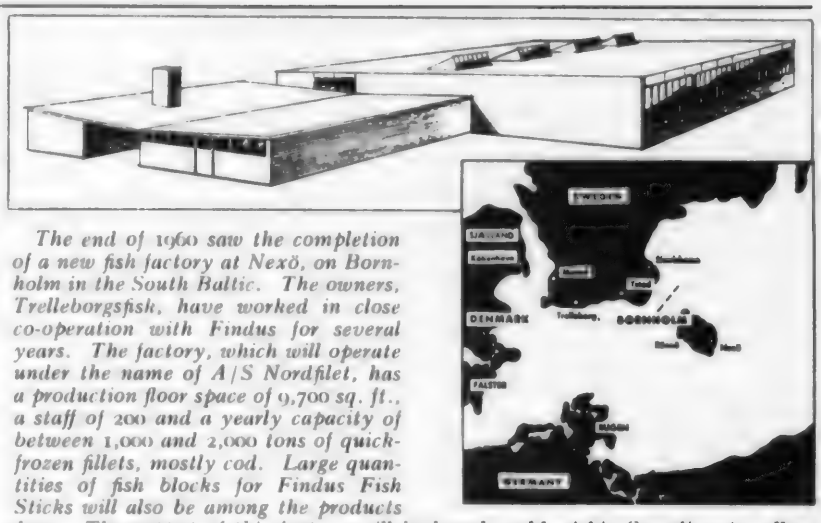
## Big Findus Expansion

A major extension of the Findus factory at Hammerfest is under way. About £1m. are being spent on the plant, situated in the world's most northerly town.

The first phase, due to be ready early next summer, comprises a large cold store with a capacity of 2,500 tons.

The factory, sited alongside a quay extended to 650 ft., will then have a total frontage of about 1,000 ft.

The third floor of the new cold store will house a special department for the preparation of frozen fish dishes. The laboratory will be extended and a special pilot plant for new fish products will be arranged. Parallel with these developments Findus are also improving the sources of raw material supply, and 16 trawlers are now working in the North Atlantic and the Barents Sea.




*The end of 1960 saw the completion of a new fish factory at Nexö, on Bornholm in the South Baltic. The owners, Trelleborgsfisk, have worked in close co-operation with Findus for several years. The factory, which will operate under the name of A/S Nordfilet, has a production floor space of 9,700 sq. ft., a staff of 200 and a yearly capacity of between 1,000 and 2,000 tons of quick-frozen fillets, mostly cod. Large quantities of fish blocks for Findus Fish Sticks will also be among the products here. The output of this factory will be largely sold within Scandinavia, allowing the factory at Hammerfest to place more fish at the disposal of Findus International.*

### Europe's biggest ice-cream factory opened in Germany

What has been claimed to be the largest and most modern new ice-cream factory on the European continent was recently opened at Heppenheim, Hesse (West Germany) by Langnese Eiskrem G.m.b.H., of Hamburg, which is a wholly-owned subsidiary of the Rotterdam Unilever concern.

The plant, which took 13 months to build, cost $6,500,000 and, whereas no details were made available regarding its capacity, it would—according to company spokesmen—surpass that of their main plant in Hamburg.

Langnese Eiskrem G.m.b.H. supplies about half the West German ice-cream market where, since 1957, the consumption of "industrially manufactured" ice-cream has gone up from 0·44 to 0·92 litres per head of population. Compared to this, the consumption of ice-cream in the U.S.A. is 22 times greater per head of population.

Though ice-cream sales depend largely on seasonal conditions, the German company hopes to overcome this barrier with deep-frozen household packs and a chain of deep-freeze units from the manufacturer to the retailer.

*This ultrasonic test unit was demonstrated recently at the 52nd International Livestock Exposition in Chicago. The instrument accurately locates layers of fat and lean, and was originally developed for detecting flaws in metals and other hard materials. It is believed to be the first time such an instrument has been used for cattle judging. In the picture, Dr. J. R. Stouffer* (left) *of Cornell University's Animal Husbandry Department is assisted by Max Wallentine who holds the probe against a Hereford steer held by Wayne Klyn, an animal husbandry student at Iowa State University.*

### Second Danish food fair

The second Danish Food Fair will take place in Aalborg between June 2 and June 11, 1961. Special air services between Copenhagen and Aalborg are being arranged.

### Australia: food science conference

The Division of Food Preservation of the C.S.I.R.O., Australia, is holding a food science conference at its new headquarters at North Ryde, New South Wales, from September 19 to 22, 1961.

The conference will take the form of three symposia, each introduced by a distinguished food scientist, and two general discussions led by panels of scientists.

Information may be obtained from the Chief, C.S.I.R.O., Division of Food Preservation, Private Bag, Homebush Post Office, New South Wales, Australia.

### U.S. award for British plate evaporator

The award for the year 1960 of the *Canner Packer* gold medal for creative progress in processing foods, awarded for "outstanding innovations or improvements in equipment or supplies used by processors of food," has gone to the A.P.V. plate evaporator. Its application to citrus juice concentration is specifically mentioned. The makers say there are 14 installations already operating in the U.S.A. or on order.

### Honduras may ban unprocessed milk

The president of the Banco Nacional de Fomento, of Honduras, has said that the Secretary of Public Health was contemplating banning the sale of unprocessed milk.

### Argentina to expand milk industry

The Argentine Banco Industrial plans to finance the installation, enlarging and modernisation of milk pasteurising and processing plants. Credits for modernisation will be granted for five years, with 8% interest for co-operatives and 10% for individuals; while credits for the installation or enlarging of plants will be granted for ten years with the same interest charge. The credits will be granted only to plants that will promote the development of new dairy farms in their area.

### U.S.A.: red colour banned

F.D. and C. Red No. 1, a water soluble coal tar colour widely used in food, has been eliminated from the F.D.A. permitted list because preliminary experiments have shown it causes liver damage in test animals and no safe use level has been established.

### South Africa: joint enterprise by Schlesinger and Coca-Cola

Negotiations are being completed whereby a joint fruit processing enterprise will be formed by the Schlesinger Organisation and the international Coca-Cola Organisation, and will become effective if Coca-Cola stockholders confirm a merger with the Minute Maid Corporation, U.S.A.'s largest citrus processor.

Schlesinger, which already produces 25% of the Union's citrus export crop, and Minute Maid have already jointly established a £400,000 citrus processing plant at Letaba in Northern Transvaal. In July this will start processing 15,000 tons of juice a year into frozen and unfrozen juice concentrate and high concentrate cattle fodder.

John Schlesinger recently said that frozen orange juice concentrate and top quality cattle fodder made from citrus waste were a comparatively new development in agricultural chemistry. But already the world demand for these products was so great that he believed his new factory at Letaba, with that of Dickon Hall at Nelspruit, would absorb enormous quantities of fruit from the surrounding areas.

### Food engineering conference in U.S.A.

A food engineering conference will be held at Michigan State University on April 11 and 12, 1961. Object is to provide information on new techniques and engineering concepts for food processing plants. Further information from Continuing Education Service, Michigan State University, East Lansing, Michigan, U.S.A.

### Wheat surplus in Australia

Australia is expected to have carry-over stocks of over 100 million bushels of wheat by the end of 1961. Minister for Primary Industry Adermann told Parliament that Australia would have a record intake estimated at 225 million bushels of wheat—about 45 million bushels more than 1959. He said Australia would start selling the 1960 crop in March or April. Export sales in 1959 were about 124 million bushels.

## New Companies

**Rio Flour (Holdings), Ltd.** (670835.) To acquire and hold shares, stocks, etc. £7. Subs.: John H. Hansford, Robert P. W. Adeane, Percival S. Beale, N. Korner, Joseph F. Lockwood, Lawrence W. Loe and Richard S. Nosworthy.

**Tuxford Broiler Co., Ltd.** (671023.) 5-7, Bridgegate, Retford, Notts. £2,000. Dirs.: John M. Harris and Mrs. Irene Harris.

**Berkshire County Bacon Association, Ltd.** (671151.) 103, Southampton Street, Reading. The income and property of the Association, whencesoever derived, shall be applied solely towards the promotion of its objects. Council: Wm. E. Bertelli, Geoffrey A. E. D. Wright, Sidney G. Brunning, Arthur Smith, Kenneth W. Woolley and Anthony R. Hall.

**Ceylon Tea Plantations Holdings, Ltd.** (671099.) City Gate House, Finsbury Square, London, E.C.2. To acquire the whole or any part of the issued share capital of the Ceylon Tea Plantations Company, Ltd., etc. £100. Subs.: Francis L. Henstock and Cyril A. Meakin.

**Offham Chicken Co., Ltd.** (671129.) Coombe Place, Offham, Lewes, Sussex. £100. Dir.: Richard N. Cannon, O.B.E.

**Keele Poultry, Ltd.** (671173.) Pepper Street, Silverdale, Newcastle, Staffs. £1,000. Dirs.: Samuel Morrey, Samuel L. Morrey, Fdk. L. Eagles, Normal Chell and Stanley J. Redfern.

**Macdonalds Fine Foods, Ltd.** (671313.) 7, Moorfields, Liverpool, 2. £100. Dirs.: Brian C. Macdonald, Sarah A. Walsh and John P. Macdonald.

**Freeze Dry, Ltd.** (671340.) To carry on bus. of mnfrs. of and dlrs. in dehydrated products, etc. £10,000. Dirs.: Edward Hack, Thelma Warder and Joyce Bell.

**W. H. Longman and Sons (Farmhouse Cheesemakers), Ltd.** (671549.) Woodcock House, Woodcock Street, Castle Cary. To acquire from North Lease Farm, Ltd., the bus. of cheesemakers carried on at North Lease Farm, Sparkford, by them, etc. £10,000. Dirs.: Wm. H. Longman, Wm. J. Longman, Richard E. H. Longman and Robert J. Hannam.

**H.B.G. (Meat) Company, Ltd.** (671712.) £20,000. Dirs.: George W. Hughes, Charles Belcher and John A. Green.

**Farmers Meat Co., Ltd.** (671701.) £100. Dirs.: not named. Subs.: Alan Peterson and David Preston.

**F.M.C. (Meat), Ltd.** (671705.) Details similar to Farmers Meat Co., Ltd.

**Whitewell Ices (Accrington), Ltd.** (671770.) Stanley Street, Accrington. £100. Dirs.: Robert T. Moore and Miss Emily Moore.

**Danish Frosted Foods, Ltd.** (671933.) Howardsgate, Welwyn Garden City, Hertfordshire. £50,000. Subs.: Thos. W. Haswell and Wm. G. Hopkins.

**Lollymix, Ltd.** (671869.) 49, St. James' Street, London, S.W.1. To carry on bus. of agents for syrups, cordials, etc. Dirs.: Wm. A. Cole and Mrs. Molly Cole, and Ronald C. Pearson.

**Inter-county (Poultry) Products, Ltd.** (671950.) Shire Oaks, Alne, York. £100. Dirs.: Stanley Beall and Basil A. Beall.

**Unique Spices Co., Ltd.** (671972.) Tansley Hill House, Oakham Road, Dudley. £5,000. To take over the bus. of a spice grinder and blender and specialist in sausage seasoning carried on by Alan G. W. Belcher at Tansley Hill House, Oakham Road, Dudley, as "Unique Spices Company," etc. Dir.: Alan G. W. Belcher.

**Coinbrook Food Products, Ltd.** (672151.) £100. Subs.: N. Marangos and J. A. Marangos.

**G. and R. Dewhurst and Co. (Frozen Foods), Ltd.** (674531.) 42, Westland Avenue, Farnworth, Lancashire. £1,000. Dirs.: Raymond Dewhurst and Mrs. Gladys Dewhurst.

**Clive Woodhead and Co., Ltd.** (674568.) 14, Drury Lane, London, W.C.1. To carry on bus. of growers, importers, exporters, canners, bottlers and processors of and dlrs. in frozen and other foodstuffs, etc. £100. Dirs.: Arnold H. Woodhead, Mrs. P. L. Woodhead, Harold V. Woodhead and Clive F. Woodhead.

**R.F.I., Ltd.** (674646.) To carry on bus. of mnfrs. of and dlrs. in fats, oils, liquors and foodstuffs, etc. £100. Subs.: G. B. Inglis and S. R. Ward.

*These particulars of new companies recently registered have been extracted from the daily register of Jordan and Sons, Ltd., Company Registration Agents, 116, Chancery Lane, London, W.C.2.*

Number 30 February 1961

# BUYERS GUIDE TO LODERS PRODUCTS

LODERS and NUCOLINE LTD.

## INFORMATION BULLETIN

| RECOMMENDED USES | COBERINE | VEBERINE | EXTRACOA | NUCOCOS | SUPERCOA | TORCOA | HYCOA 6 | HYCOA 5 | VEBOL | HYCOA 4 | HYCOA 2 | COCOS A | HYCOA 1 | ICECOA | NUCOLINE A.H.B. | POLARINE | NUCOLINE W.S.B. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Toffees & Caramels | | | † | † | * | | | * | | * | * | * | * | | * | | * |
| Fudge | | | † | † | * | | | * | | | | | * | | | | |
| Cream Pastes | | | | † | | | | | | * | * | | * | | * | | * |
| Couverture | † | * | | | | | | | | | | | | | | | |
| Light & Dark Coatings | | | † | | † | | | * | | * | | | * | | | | |
| Baker's Coatings | | | | | | | * | * | | * | | | * | | | | |
| Tropical Coatings | | | | | | † | | | | | | | | | | | |
| Ice Cream Coatings | | | | * | | | | | | | | † | * | | | | * |
| Ice Cream | | | | | | | | | * | | | | | † | | † | * |
| Biscuit Cream Fillings | | | | † | | | | * | | * | * | * | * | | * | | * |
| Puff Biscuits & Cream Crackers | | | | † | | | | | | | * | * | | | | | |
| Biscuit Dough Fat Components | | | | | | | | * | * | * | * | * | * | | * | | * |
| Fondant Icing | | | † | | | | | | | | | | | | | | |

*—Recommended Uses.
†—Specially Recommended Uses.

*The Loders & Nucoline Technical Service Department will be pleased to supply any further information concerning the applications and usage of the above fats.*

*This advertisement is one of a series of Information Bulletins issued by Loders & Nucoline Ltd. Copies are available, together with a folder, on request to Loders & Nucoline Ltd., Unilever House, London, E.C.4.*

LN 75·8058

# STAINLESS STEEL

SHEET

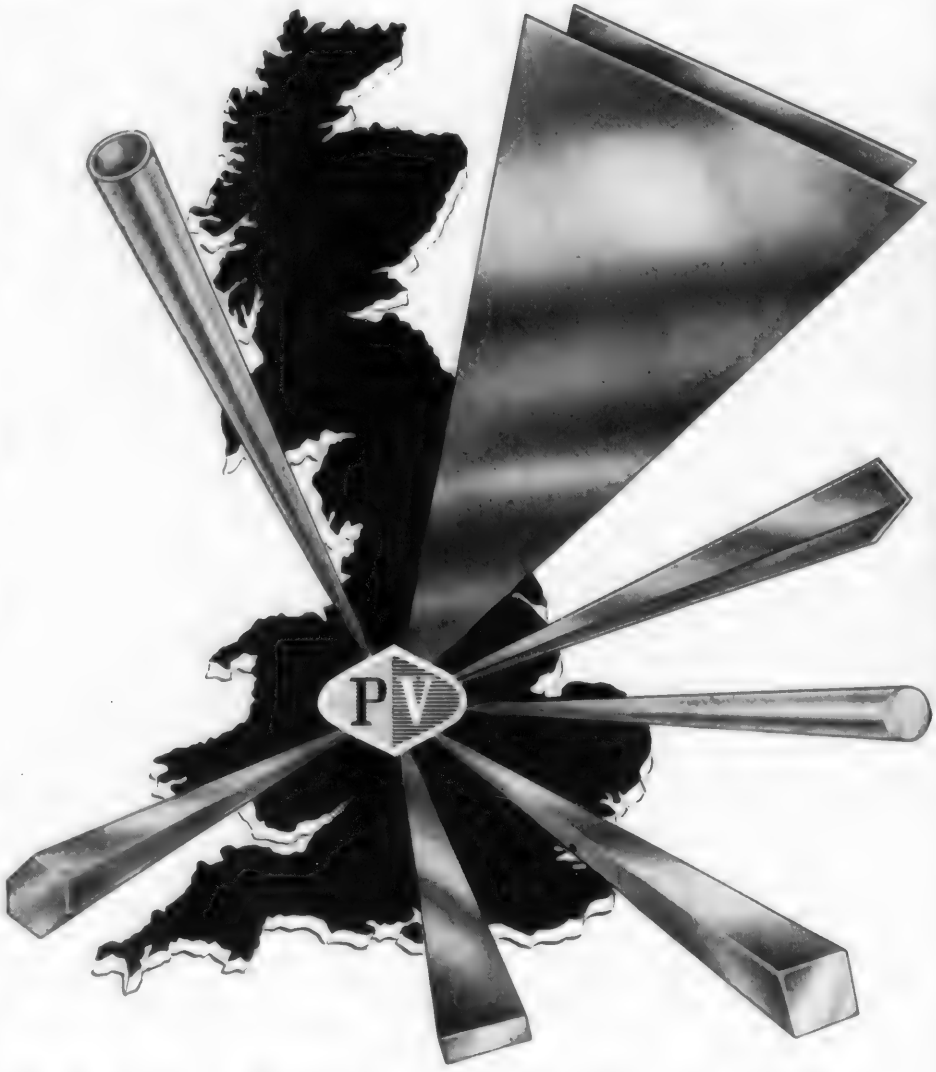
STRIP

BAR

TUBE

SECTIONS

FASTENINGS

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*25 Years experience in the processing of Stainless Steel*

# Mechanise your WAFER production

*(and incorporate existing wafer ovens if necessary)*

*Two 24-plate ovens (right) feeding by conveyor to spreading and sandwiching machine (left).*

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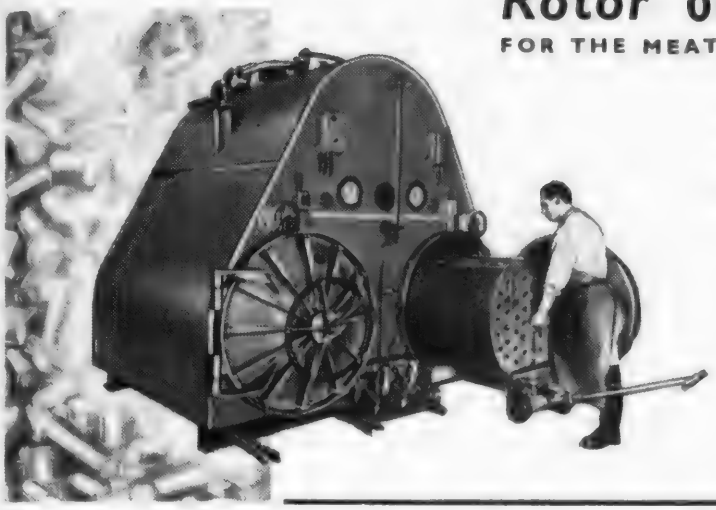

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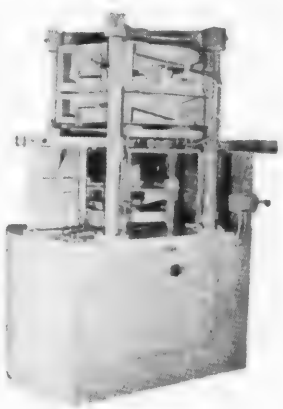

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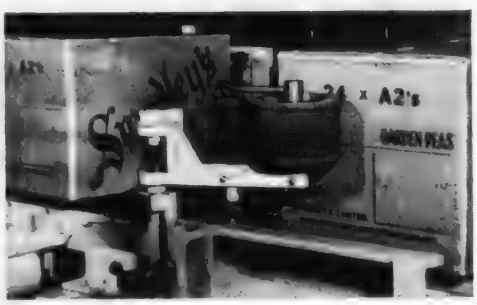


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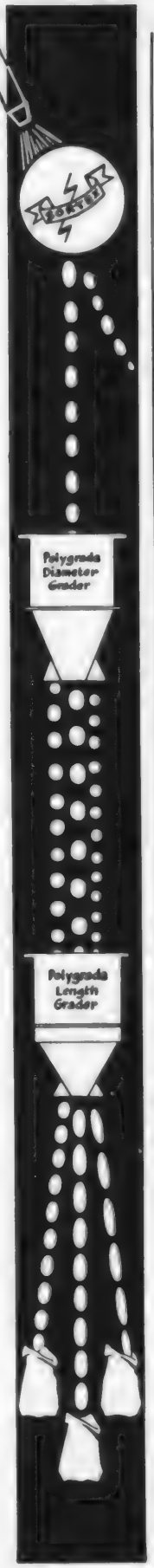


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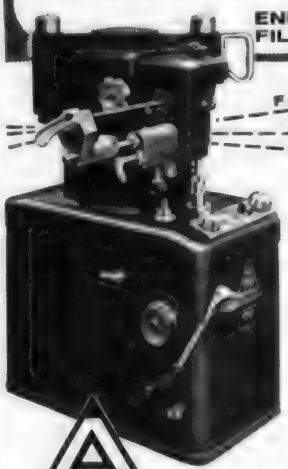

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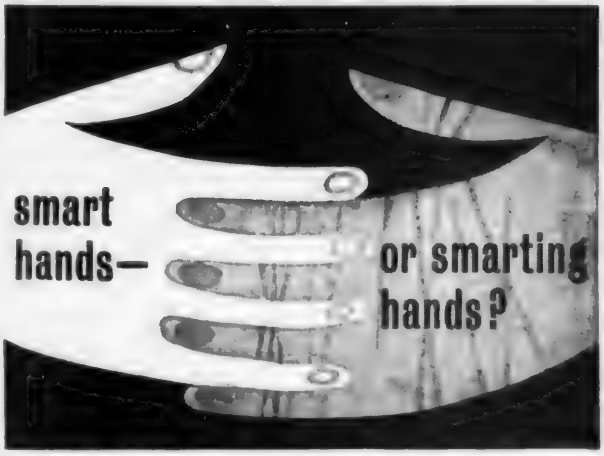


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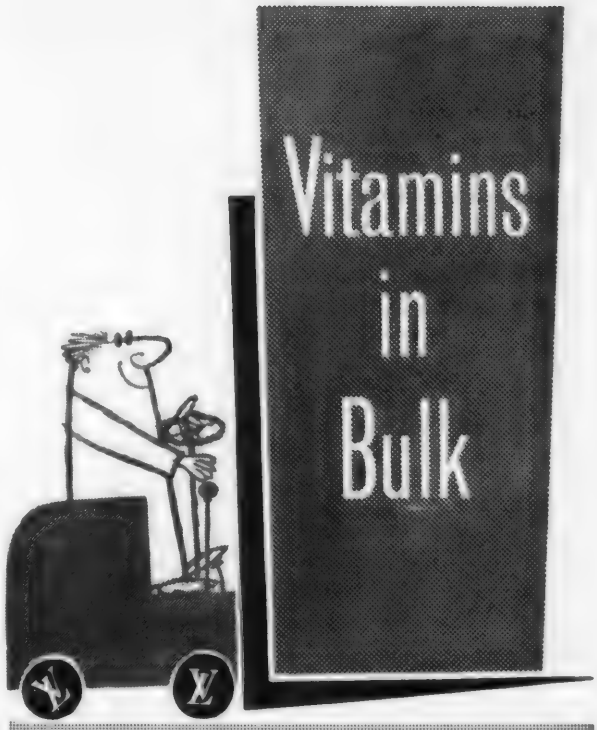


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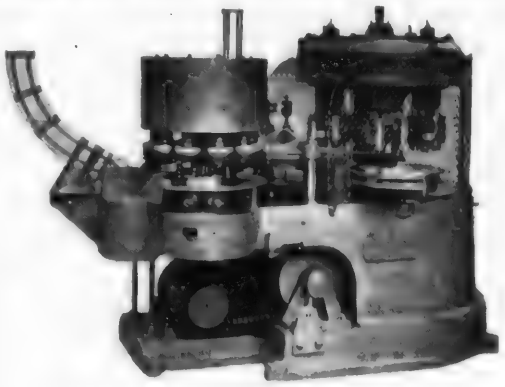

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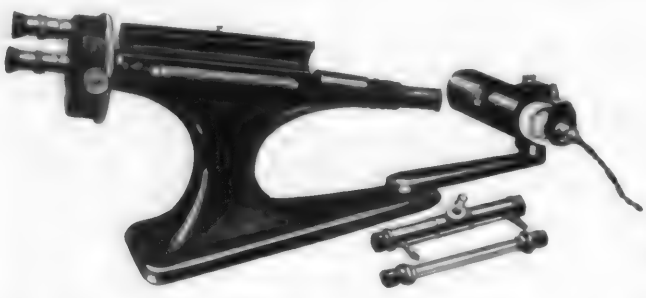

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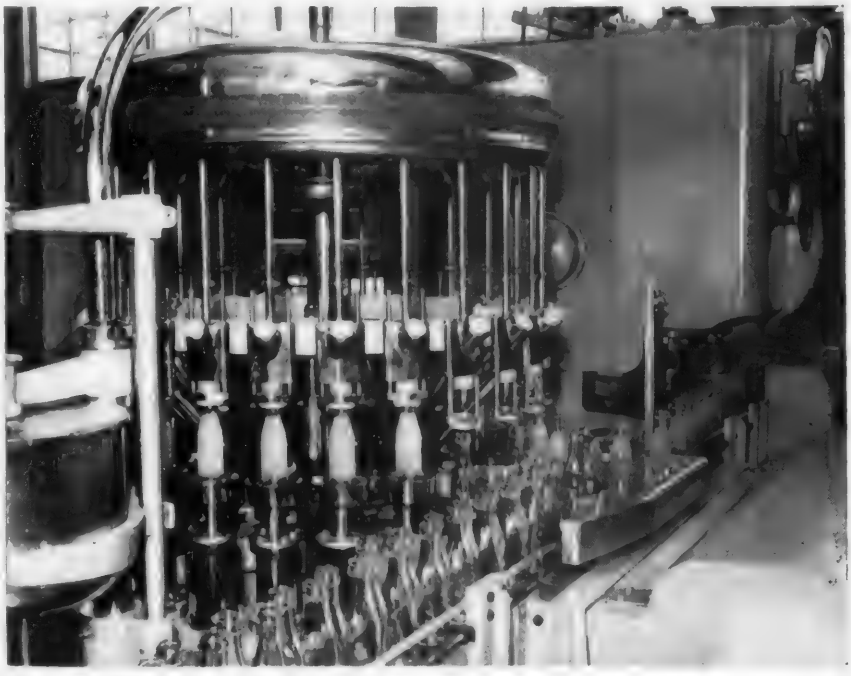

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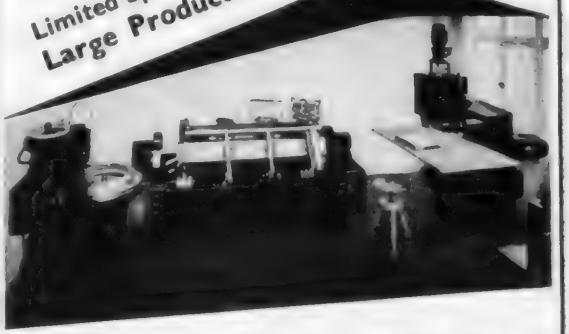

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## PATENTS

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**Ref. A.995.** British. Male. Married. Age 35. H.N.C.Mech., endorsements principles of electricity. industl. admin., Grad.I.Mech.E., applied transfer to A.M.I.Mech.E. 2½ years. Apprentice Engineer, rayon yarn manufacturer. 4 years Apprentice Engineer and Draughtsman, power plant and refrigeration. 3 years Draughtsman, heavy chemical plant. 9 months Draughtsman on plant development, acetate yarn and fabric manufacturers. 6 years Design and Development Engineer, medium and light machinery. At present Design and Development Engineer, civil construction and mechanical engineers. Experience administration and supervision technical and operative staff on manufacturing installation, maintenance and development of machinery, & technical writing & teaching experience. Seeks **SENIOR TECHNICAL ADMINISTRATION AND/OR MANAGEMENT POST—CONSIDER ALL OFFERS INCLUDING TECHNICAL REPRESENTATION,** if prospects good. U.K.—not London, £1,500 p.a. min.

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**Ref. B.4.** British. Male. Married. Age 35. O.N.C. (Mech. Engg.). 3½ years Draughtsman, plastics engineering. 1 year Senior Draughtsman, turbines 5½ years Senior Draughtsman, aircraft. 9 months Assistant Chief Draughtsman, engineering. 2 years i/c Diesel Engine Installation Drawing Office, diesel engines. At present Section Leader, turbines & turbochargers. Seeks post **AS SENIOR DRAUGHTSMAN, SECTION LEADER OR CHIEF DRAUGHTSMAN.** S. or W. England (not London), U.S.A. or Europe. £1,000 p.a. min.

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**Ref. B.9.** British. Male. Single. Age 22. O.N.C. Aero H.N.C.Mech. (Structures). 2 years Junior Design & stress Engineer & at present Design Engineer, commercial & aircraft engineers. Apprenticeship in practical aircraft engineering. Seeks **POST AS DESIGN ENGINEER,** Hampshire (peferably Southampton area). £800-£1,000 p.a.

**Ref. B.10.** British. Male. Married. Age 26. H.N.Dip.(Mech). 1 year Student Fitter, welding equipment. 6 months Draughtsman, gravity die designers. 6 months Draughtsman, contract office. 2½ years Development Engineer, aircraft air conditioning. At present National Service with R.A.F. Seeks post **AS DEVELOPMENT ENGINEER.** London or London area. £1,000 p.a.

**Ref. B.11.** British. Male. Single. Age 28. Hons. B.Sc. Chem. Engg. 1 year Laboratory Demonstrator, Canadian university. 1 year Rubber Compounder, rubber tyre manufacturers. 1 year Production Supervisor & Development Chemist, pharmaceutical manufacturers. 2½ years Process & Project Engineer, oil & fat refining & margarine production. Languages: French, Italian & Greek. Seeks **RESEARCH, DEVELOPMENT, MARKET RESEARCH, TECHNICAL SERVICE OR MANAGEMENT TRAINEE POST**—preferably in chemical industry. London or S. England or France, Italy or Greece.

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*[Continued on next page*

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Name: .....

Position: .....

Company: .....

Business or Profession: .....

Address: .....

All introductions are made on the understanding that should an engagement result the employer agrees to I.S.I.S. Appointments Register's terms, which are as follows:

*For each person engaged the equivalent of two weeks salary payable by the employer within fourteen days of the date of engagement.*

Signature..... Date.....

# I.S.I.S. APPOINTMENTS REGISTER

(Continued from previous page)

**Ref. B.13.** British. Male. Married. Age 24. O.N.C. 5 years Apprentice, marine engineers & ship repairers. 9 months Junior Engineer Officer & 2 years 4th Engineer Officer, ship owners. At present Sea-going Marine Engineer, shipowner. Seeks post as **ENGINEER OR DRAUGHTSMAN—PREFERABLY WITH SOME KIND OF INITIAL TRAINING.** U.K. £800 p.a.

**Ref. B.14.** British. Male. Married. Age 37. 2 years Design Draughtsman, glass containers. 2½ years Technical Assistant, buildings & industrial services. 2 years Self-employed Designer. 2 years Designer/Development Engineer, consulting engineers. 2½ years Plant Engineer, telecommunications electronics. 1½ years Assistant Chief Engineer, carbon papers & typewriter ribbons. At present Group Development Engineer, hotels & motion picture industry. Seeks post as **CHIEF WORKS ENGINEER.** S. America. £1,400 p.a.

**Ref. B.15.** British. Male. Married. Age 28. 1st Class Hons. Dip. in Civil Engg., Grad. Inst. of Civil Engrs. 3½ years experience in contractors/design office. At present Civil Engineer, contractor-design engineer on large projects. Seeks post as **SITE ENGINEER (RESIDENT OR CONTRACT).** U.K. —not London. £1,300 p.a.

**Ref. B. 17.** British. Male. Married. Age 37. Apprenticed toolmaker & machinist. 16 years Toolmaker Instructor & Overseas Representative, rail car & plant engineers. 6 years Tester In Charge, aero engine manufacturers. 2 years Superintendent in Jamaica with omnibus operators. Seeks post as **ENGINEER (MECHANICAL) SUPERVISOR FOR WORKSHOPS, TRAINING SCHOOL, OR INSPECTION POST.** S. England, West Indies, S. America, Australia or S. Europe. U.K. Salary £1,000 p.a.

**Ref. B.18.** British. Male. Married. Age 55. A.R.S.M. & B.Sc. in Mining & Mining Geology. M.Sc. (Geology), M.Inst.M.M. 3 years Field Engineer & Geologist, Yugoslavia. 5 years Senior Assistant Geologist, Korea. 6½ years General Technical Assistant to Manager, S. African minerals development concern. 7 years Chief Geologist, Africa. 3 years Geologist, Mining Section of U.N. in Korea. 1½ years Geological Adviser to overseas government with U.N. 6 months Assistant General Manager & Geologist, Peruvian mining company. Seeks appointment **APPROPRIATE TO QUALIFICATIONS & EXPERIENCE.** Anywhere but preferably abroad. £2,000 p.a. approx.

**Ref. B.19.** British. Male. Married. Age 51. A.C.S.M., A.M.I.M.M. 1 year Learner/Miner, tin mine. 3 years Geologist, drilling department of oil company. 2 years Surveyor Site Engineer, civil engineering contractors. 2 years Geological Surveryor, Cartography, oil company. 4 years Surveyor/Prospector/Underground Manager, gold mine. 1 year Mine Manager, gold mine. 12 years Geologist, production department, opencast coal mining. At present Geologist/Prospecting Officer, opencast coal mining. Seeks post as **MINING ENGINEER FOR SALES ENGINEER OR MINING PLANT/ECONOMIC GEOLOGIST/DRILLING SUPERINTENDENT.** U.K., Europe, Australasia, Canada, U.S.A., S. America, Asia Minor, S. Africa or Nigeria. £1,400 p.a. min.

**Ref. B.20.** British. Male. Married. Age 37. Inter. B.Sc.(Eng.)., A.M.I.C.E., A.M.I., Struct.E. 4 years Designer, chemical manufacturers. At present Senior Civil Engineer, chemical engineering contractors. Seeks post as **CIVIL ENGINEER FOR CHEMICAL ENGINEERING CONSULTANTS OR CONTRACTORS OR MANUFACTURERS.** London or East Anglia. £1,750 p.a. min.

**Ref. B.21.** British. Male. Married. Age 43. R.S.A. Cert. in Maths. & Engg. Drawing. 2 years Technical Repairs, welding machines. 1 year Technical Repairs, gas & arc welding rods & electrodes. 1 year i/c Estimating & Costing, wire drawing machines. 7 years Apprentice Supervisor, aircraft company. 1½ years i/c tool room, plastics (tools & machinery). 1½ years Manager, general engineering & tools. 6 years Toolmaker, contract toolmakers & research engineers. 2 years Improver, industrial instrument makers. 5 years Apprentice, tobacco machinery. At present Technical Sales Engineer, resistance welding machines. Seeks **TECHNICAL SALES, SUPERVISORY OR ADMINISTRATIVE POST.** S. England. £1,500 p.a. approx.

**Ref. B.22.** British. Male. Married. Age 39. B.Sc. (Mining Engg.), A.R.S.M., A.M.I.M.M., M. American Inst. Mining, Metallurgical & Petroleum Engineers. 10 years from Assistant Mine Foreman to Superintendent, base metal mining. 2 years Assistant Mine Superintendent, base metal mining. 6 months General Manager, production of glass sand & silica flour. Seeks post **AS MINES SUPERINTENDENT/ASSISTANT MINES SUPERINTENDENT.** Abroad.

**Ref. B.23.** British. Male. Married. Age 31. Engg. Apprenticeship. Studying 3rd year O.N.C. 1 year Technical Sales Representative, woodworking machinery. 3 years Technical Sales Representative, motor & aircraft components parts. At present Draughtsman, heavy engineering. Seeks post **AS CONTRACT ENGINEER, DRAUGHTSMAN OR TECHNICAL REPRESENTATIVE.** London or Kent. £1,000 p.a. min.

**Ref. B.24.** British. Male. Married. Age 25. H.N. Dip. in Mech. Eng. (Structural Group). Grad. I Civil Eng. 5 years Apprentice Draughtsman, steel manufacturers & fabricators. ½ years Structural Engineering Assistant, consulting engineers. At present Assistant Design Engineer, civil engineering contractors. Seeks **TECHNICAL ADMINISTRATION OR CONTRACTS ENGINEEINEERING** post. London or Newcastle-upon-Tyne. £1,050 p.a. min.

**Ref. B.25.** British. Male. Married. Age 39. H.N.C. (Elec. Engg.). M. Inst. of Welding. 9 years Apprentice & Draughtsman, switchgear specialists. 7 years Contracts Manager & 3 years Production Controller, switchgear specialists. 4 years Works Director, heavy welded fabrications & special purpose vehicles. Seeks post **AS WORKS MANAGER OR SIMILAR.** Anywhere considered. £2,000 p.a. approx.

**Ref. B.27.** British. Male. Married. Age 26. O.N.C. Mech. Studying for final year H.N.C. 7 years Draughtsman, steel plant fabrication. At present Design Draughtsman, heavy engineering. Seeks post **AS SENIOR DESIGN DRAUGHTSMAN,** U.K.—Woolwich, Dartford area preferred. £20 per week.

**Ref. B.28.** British. Male. Married. Age 36. Nat. Cert. in Mech. Engg., A.M.I.E.D., A.R.Ae.S. 5 years Engineering Apprentice, special purpose machinery. 5 years Draughtsman & Development Designer, manufacturers aero-petrol & gas turbine engines. 1 year Design/Draughtsman, automobile manufacturers. 2½ years Designer, areo-gas-turbines. 1½ years Senior Designer, gas-turbines (industrial & aero) manufacturers. At present Chief Development Engineer (gas turbines), manufacturers of internal combustion engines, commercial & armoured vehicles. Seeks post **OFFERING GREATER ADMINISTRATIVE RESPONSIBILITIES.** U.K. —not London—U.S.A. or Europe. £1,750 p.a. min.

**Ref. B.29.** British. Male. Married. Age 29. O.N.C. Mech. Engg. 1st Class M.O.T. (Steam & Motor), A.M.I.Mar.E. 5 years Apprentice Engineer, shipbuilders & engineers. 7 years Junior Engineer/Senior 2nd Engineer, passenger & freight service. 7 months Experimental Officer, fish preservation. At present Test Rig Engineer. Seeks post as **MECHANICAL ENGINEER.** Scotland or abroad. £1,000 p.a.

**Ref. B.30.** Belgian. Single. Age 37. Mech. Technician Cert. Studying for A.M.S.E. exam. 3 years Salesman, motor-car dealers. 1 year Interpreter, supply stores. 1 year Draughtsman, electrical applicances. 14 years Engineer Assistant engaged in technical & supervisory work with dredging contractor. Seeks post as **ENGINEER-ASSISTANT OR SALES ENGINEER.** Abroad—preferably S.E. Asia. £1,500 p.a.

**Ref. B.31.** British. Male. Married. Age 25. B.Sc. (Chem. Engg.). 5 years Technical Service Engineer, Petroleum refining abroad. Seeks post as **PROCESS OR TECHNICAL SERVICE ENGINEER.** Anywhere U.K. Salary £950 p.a. min. Overseas £1,300 p.a. min.

**Ref. B.32.** British. Male. Married. Age 24. O.N.C. Elect. Engg. & Heat endorsement. H.N.C. Mech. Engg. & Hydraulics Endorsement. Grad. I Mech.E. 5 years Student Apprentice, ordnance factory. 5 months Design Draughtsman, ordnance factory. 2½ years Seagoing Engineer, shipowners. Seeks post as **PROFESSIONAL MECHANICAL ENGINEER.** London or N. Kent. £850/£900 p.a.

**Ref. B.33.** British. Male. Married. Age 50. B.Sc. (Eng.), Dip. in Applied Science, A.M.I.Mech.E. 1½ years Assistant Engineer, electrical power company. 2 years Assistant Engineer, oil company. 6½ years Assistant Engineer, brewers. 5½ years Chief Engineer, food processing. 2½ years Chief Engineer, biscuit manufacturers. Seeks **PLANT MAINTENANCE OR SIMILAR POST.** U.K.—London preferred. £1,800 p.a. min.

**Ref. B.34.** British. Male. Single. Age 26. B.Sc. (Geology). 3 years Geologist, petroleum company, abroad. Seeks post as **GEOLOGIST.** Abroad anywhere except Middle East. £1,500 p.a.

**Ref. B.36.** British. Male. Married. Age 27. Studied to Grad. I Mech.E. 4 years Pupil, general engineers. 1 year Draughtsman, aircraft manufacturers. 2½ years Draughtsman, chemical & food machinery. At present Plant & Maintenance Engineer, synthetic resin manufacturer. Seeks post as **PLANT MAINTENANCE ENGINEER.** U.K.—not London area—£900/£1,000 p.a.

**Ref. B.37.** British. Male. Married. Age 27. O.N.C. standard in Mech. Engg. 7½ years Apprentice Draughtsman & Junior Draughtsman, ironfounders, structural & general engineers. At present Senior Draughtsman, aero & rocket engines & ground equipment. Experience of costing office, stores, fitting, welding, structural work & estimating. Seeks post as **ASSISTANT OR TRAINEE WORKS MANAGER.** U.K. £1,050 p.a. min.

**Ref. B.38.** British. Male. Married. Age 33. B.Sc. (Physics). 4 years Research Physicist, rubber manufacturers. 3 years Technical Officer, nylon manufacturer. At present Physicist, laminated plastics. Seeks **EDUCATIONAL / SCIENTIFIC / EXECUTIVE POST.** London or South Coast area. £1,350 p.a.

**Ref. B.39.** British. Male. Married. Age 42. B.Sc. Chem. Physics & Pure Maths. 4 years Chemist, electricity generation. 6 years Sales Manager, cigarette manufacturer. 4 years Clerical Work, electricity distribution. At present Assistant Chief Chemist, asphalt. Experience analysis of coal, water, steel, slag & boiler deposits. Post grad., courses on corrosion & its prevention & uses & applications of sequestering agents. Seeks post as **CHEMIST—ANALYTICAL (INORGANIC) OR DEVELOPMENT.** London. £1,200 p.a.

**Ref. B.40.** British. Male. Married. Age 35. H.N.C. Elec. & Mech. with endorsements. A.M.I. E.E., G.I.Mech.E. 6 years Apprentice & Trainee, & 2 years Junior Engineer, heavy power plant manufacturer. 4 years Engineer & Manager, Electricity Supply abroad. 3 years Main Grade Mechanical & Electrical Engineer (Works Services), Air Ministry. At present Senior Design Engineer (conventional power plant), nuclear power station design & construction. Planned maintenance, heating & ventilation experience. Seeks post as **WORKS ENGINEER OR TECHNICAL EXECUTIVE,** U.K.—preferably N.W. England—not London. £1,800 p.a.

**Ref. B.41.** British. Male. Single. Age 21. H.N.C. (Mech.). S.I. Mech.E. 4 years Grade "A" Indentured Apprentice & at present Fire Engine Design & Detail Draughtsman, commercial municipal & fire engine manufacturers. Seeks post as **MECHANICAL ENGINEER.** London or S.E. England. £725/£750 p.a.

**Ref. B.42.** British. Male. Married. Age 27. B.A. (Mech. Sciences). G. Inst. Welding. 1 year Student Apprentice, electrical engineers. 1½ years Computor, exploration geophysicists. 1½ years Management Trainee. 1 year Works Engineer & now Deputy Works Manager, engineers, fabricators by welding of plant for petroleum & chemical industries. Seeks post as **ADMINISTRATIVE ENGINEER.** New Zealand or S. Africa. £1,750 p.a.

**Ref. B.43.** British. Male. Married. Age 27. O.N.C. Chem. 1st Final C. & G. Paint Technology. 5 years Apprentice & 1 year Works Chemist, paint manufacturers. 3 years Development Chemist, paint & varnish manufacturer. At present Technical Service Chemist, pigments manufacturers. Seeks post as **TECHNICAL SALES REPRESENTATIVE PREFERABLY SELLING RESINS OR PIGMENTS TO SURFACE COATING & PLASTICS INDUSTRIES.** S. England or Midlands. £1,000 p.a.

**Ref. B.44.** British. Male. Married. Age 28. O.N.C. Mech. & studying for final H.N.C. Engg. Apprenticeship. 5 years Engineer, R.N. 2 years Draughtsman, chemical manufacturers. At present Design Draughtsman, chemical plant engineers. Seeks post as **ENGINEER (MECHANICAL).** London. £1,000 p.a.

**Ref. B.45.** British. Male. Married. Age 25. P.S.T. II. Workshop Courses I-IV, U.L.Cl. Full Technological Cert. 6 years Apprentice & 2½ years Skilled Production Work, aircraft. At present engaged in Production Work, aircraft manufacturer. Seeks post as **ENGINEERING REPRESENTATIVE OR PRODUCTION ENGINEER.** U.K. £850 p.a.

**Ref. B.46.** German. Male. Married. Resident U.K. Fluent English & German. 3½ years Apprentice, scientific instrument engineers. 1 year Prototype Engineer, optical instruments. At present Prototype Engineer, electronic instruments. Seeks post as **SALES OR SERVICE REPRESENTATIVE.** London—preferably S. London—£850 p.a.

**Ref. B.47.** British. Male. Married. Age 45. Assoc. Royal School of Mines. M.Inst. M.M. 15½ years Technical Assistant/Mine Manager, metalliferous mining. 6½ years General Manager for Mineral Production in Turkey, mining mineral control & purchasing refiners. Considerable general administrative experience in all branches engineering. Seeks **APPOINTMENT (PREFERABLY TECHNICAL/ADMINISTRATIVE) CONNECTED WITH MINING OR MINERAL INDUSTRY.** U.K. £1,500/£2,000 p.a.

**Ref. B.48.** Male. British. Married. Age 48. Royal Botanic Garden Cert. 3 years Apprentice, nursery & market gardeners. 5 years Student Gardener, botanic garden. 23½ years Farm Superintendent, banana, cocoa, oil palm growers in tropical American countries. Experience management large numbers farm workers, housing, labour disputes, crop & cash estimates, soil surveys for future plantings & supervision of planting & draining. Seeks post as **FARM SUPERINTENDENT OR MANAGER IN ANY TROPICAL COUNTRY**—preferably American Tropics. £1,800 p.a.

**Ref. B.49.** British. Male. Married. Age 35. B.Sc. (Physics & Maths). A. Inst. P. 1 year Research Physicist, optical company. 1 year Technical Officer, industrial chemicals. At present Lecturer in Physics. Local education authority, including arranging courses for local industries. Seeks post as **EDUCATION/TRAINING OFFICER.** N. England or Scotland. £1,600 p.a.

**Ref. B.50.** British. Male. Married. Age 30. Nat. Cert. Mech. Eng. H.N.C. Prod. Engg. A.M.I. Prod.E. 5 years General Engineering Apprenticeship. 1½ years Assistant to Production Manager, manufacturer of small tools. At present Assistant Production Manager, manufacturer of machine tools. Seeks post as **PRODUCTION MANAGER/CONTROLLER OR ASSISTANT WORKS MANAGER.** U.K. (not London), Australia, New Zealand or Canada. £1,400 p.a.

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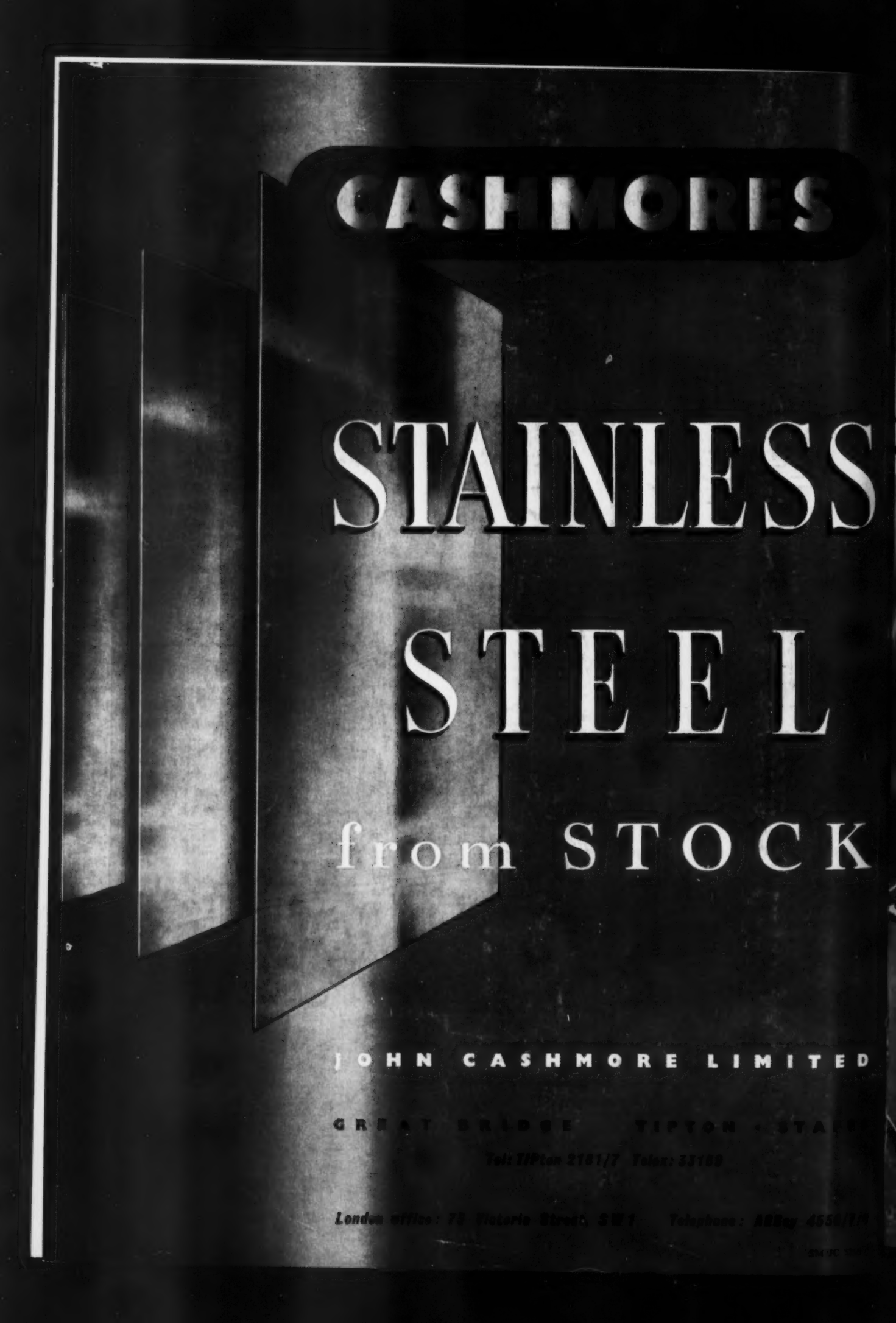
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